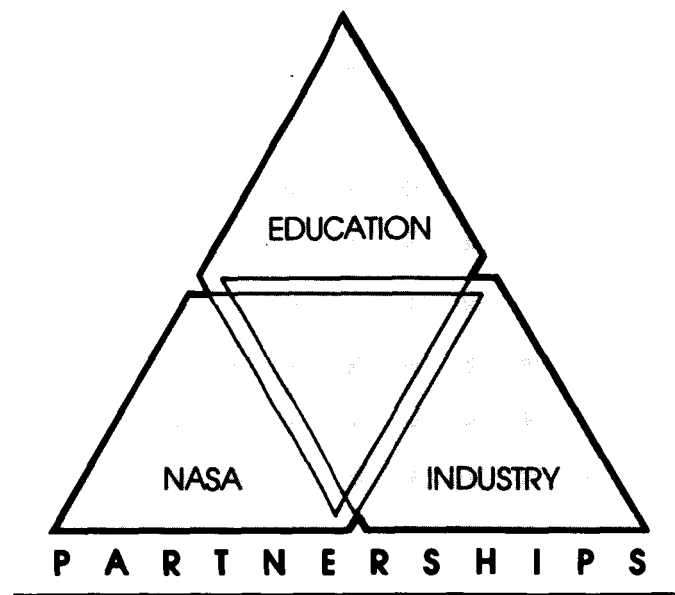


The Future Work Force Conference Proceedings

Goddard Space Flight Center
September 10-11, 1986



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THE FUTURE WORK FORCE CONFERENCE PROCEEDINGS

**September 10-11, 1986
Goddard Space Flight Center
Greenbelt, Maryland**



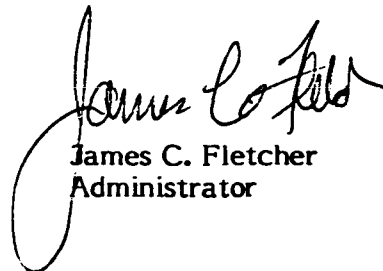
**NASA OFFICE OF EDUCATIONAL AFFAIRS
AND
NASA OFFICE OF PRODUCTIVITY PROGRAMS
WASHINGTON, D.C. 20546**

FOREWORD

NASA recognizes the significance of quality and productivity as crucial components of our Nation's economic strength and well being. Through our long-term partnership with the private sector, we can shape a brighter future for America. We must bring all our resources, talents, and skills to bear in achieving that objective.

The future of NASA lies in its people; those directly working for the agency, those in corporations and universities that do research in basic aeronautics, space science and engineering, and those in industry who translate new knowledge and new skills into products and services.

The national educational system, in all its diversity and with all its challenges, is our basic resource for human competence. The system is crucial in maintaining the partnership of industry, universities and government that sustains American leadership in space and aeronautics. The Future Work Force Conference testifies to NASA's commitment to the promise of that partnership, now and in the future.



James C. Fletcher
Administrator

PREFACE

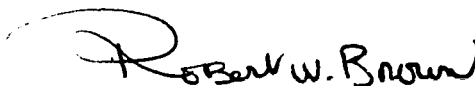
It is with great pleasure that we present the Future Work Force Conference Proceedings held September 10 and 11, 1986, at Goddard Space Flight Center in Greenbelt, Maryland. The NASA Offices of Education and Productivity jointly sponsored the two day conference in the belief that joint NASA, industry and academia long-term objectives must be established to improve the quality of our future work force. We believe the information documented on the following pages will contribute meaningfully to that end and will set a precedent for future efforts.

Productivity growth, without question, serves as a revealing barometer for the general health of a country's standard of living; it is instrumental in determining the nation's competitive position. The level of work force education has proved to be a primary factor in determining productivity growth--more powerful now because of our technological society.

The workers of tomorrow are sitting in the classrooms of today; the skills and work attitudes they acquire over the years will play a vital role in determining the future of America's productivity. The synergism of the partnership between industry and education will foster the crafting of methods that will upgrade our educational system. Our challenge is clear--we have a shared responsibility and a vested interest in upgrading educational opportunities; it is up to us to help provide for our future work force requirements.



Joyce Jarrett
Deputy Director
NASA Productivity Programs



Robert W. Brown
Director
NASA Educational Affairs Division

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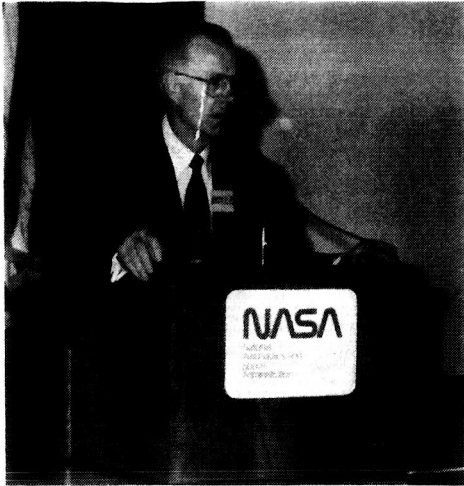
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FUTURE WORK FORCE CONFERENCE
September 10-11, 1986
NASA Goddard Space Flight Center

OPENING REMARKS



Mr. Charles P. Boyle
Special Programs Officer
NASA Goddard Space Flight Center



Mr. Elva Bailey
Educational Programs Officer
NASA Goddard Space Flight Center

BOYLE: We at Goddard Space Flight Center are delighted to be hosting this conference. Someone once said, "As I age and my eyes fail, my vision improves." My vision tells me that we're all starting something very important here today.

We've already set one milestone: We started on time! To keep on time with a powerful group like this...from business, industry education and government...we have two people presiding. You see our names in the program. I'm Charlie Boyle, co-host with Elva Bailey.

These two days are designed to give you maximum time to confer with each other. There are panels, question and answer sessions, discussion periods, mixers, tours, and an open house. Notice that there are no speakers at the two lunches, and there is no speaker at the evening dinner. These times are for you and those people you would like to meet.

Dr. Hinners, Goddard's Director, asked me last month about the nature of this conference. I told him that this conference will not consider "the problem." Instead, we will try to evoke, from acknowledged leaders in industry and the schools, a description of what they are doing to help the situation.

We are here to learn about the successful and promising activities that are going on in partnering. We are here to seek action and remedy.

NASA WELCOME AND OVERVIEW-THE PRODUCTIVITY PERSPECTIVE

Introduction of Ms. Joyce Jarrett

BOYLE: Now I'd like to introduce to you Joyce Jarrett, who is the Acting Director, NASA Productivity Programs, Office of the Administrator. We're especially proud of Joyce because she is a Goddard product. Joyce has spent most of her 20 years with NASA at Goddard Space Flight Center, in the areas of resources and business management. She was Head of the Business Management Branch, Earth and Space Sciences Directorate, until she transferred to Headquarters in April 1985. At Headquarters, she was the Deputy Director of the NASA Productivity Programs Office and was made Acting Director in May 1986.

NASA WELCOME AND OVERVIEW-THE PRODUCTIVITY PERSPECTIVE

Ms. Joyce Jarrett
Deputy Director of Productivity
NASA Headquarters



JARRETT: Good morning. I'm delighted to be here today. I have two reasons for saying this: first, I feel like I've come back home. Second, and more important, I believe this two-day gathering has the right make-up of people or, really, the right team--NASA, industry, and education--to make a giant step toward identifying initiatives and establishing alliances with elementary and secondary schools to improve the quality of our future work force.

The primary reason we are here today is to try to find answers to some of the questions that our society is currently facing. Will our children be prepared to meet technological demands requiring a broader base of knowledge, an inquiring mind, and a quality work ethic? We're experiencing the "graying" of NASA--NASA is 25 years old. Can we be sure that our future work force will be able to continue our leadership in space? Will America be a leader in productivity and technical development, or will we lose ground as other nations accelerate their own programs? This is the challenge facing us.

When we consider human resources in terms of America's competitive position, we must assess the quality of our labor pool. The quality issue becomes more important as other nations gain in sophistication and our technological edge fades. One of the most significant lessons we've learned is that our current formal education processes could be improved in terms of preparing our young people to fully realize their natural creative potential.

I would like to give you a brief description of NASA. It is composed of 22,000 civil servants and approximately 133,000 contractor employees. Its budget is approximately \$7.3 billion, of which almost 80% funds contractors. In addition to Headquarters, there are nine geographically dispersed centers, which are semiautonomous. Just over half of NASA's employees are scientists and engineers. The Agency is justifiably concerned about the future recruitment and retention of college graduates, but it is also concerned about the training of

people to run the factories of the future. It will come as no surprise that the NASA Productivity Programs Office has as one of its primary objectives a measureable improvement in the quality of our future work force.

I'd like to give you a brief overview of NASA's Productivity Program. We are seeking to improve the quality of the work in our organizations. Our concern is that the Nation seems to be locked in a declining productivity growth rate. Productivity, for those who are unfamiliar with the term, is defined as gross national product (GNP) divided by number of employees, or, alternatively output over input; results over cost; achievements over effort. Productivity growth is a learning curve. The ability to compete is directly related to national productivity growth, which measures our improved learning rate for producing goods and services. When our productivity growth increases, it means we've learned to do more--to produce more with the same number of people.

We realize that lower productivity and decreased quality over a period of time have a direct and devastating impact on our standard of living. For example, in the 1980's both spouses must work to equal the purchasing power of one working spouse in the 1950's. A "starter house," often turns out to be the final home. College graduates are returning home to live with their parents because they can't afford a place of their own.

Without question, our industrial leadership and technological powers are being challenged. From 1973 to 1984, Japan's productivity growth rate was over 3 1/2 times that of the United States, and we led only one of the top industrial nations. The Japanese productivity growth rate is holding at 9%, while we're struggling with a 2.2% growth rate. One of NASA's Agency goals is to lead the development and application of advanced technology and management practices which contribute significantly to both Agency and national productivity. To do this we must have a qualified and motivated work force.

There are four themes in our Agency-wide goal: Employee Participation, Climate for Excellence, Contractor Involvement, and National Leadership. Our Educational Outreach Program falls under National Leadership.

Japan has shown that a dedicated nation with a strong work ethic can gain power and status in the world. It has emphasized industrial and technological development and trade, and so far, has been successful. The message is clear. The United States cannot continue to do business as usual. We must adapt, adjust, and change in order to survive in world class competition.

Japan's extraordinary strengths in the area of productivity bring me to my next point. A major reason for Japan's phenomenal success is its educational philosophy; the Japanese respect teachers. Under Japanese law, teachers are paid 10% more than the high level civil servants and are in the top 25% of wage earners. The Japanese also have respect for authority and discipline. Students attend school 240 days per year; students in the United States attend school 180 days per year. The Japanese adhere to the "hard work" ethic. A National Institution of Education Study in 1982 showed that 36% of Japanese high school students spent over 10 hours per week studying. This is more time than is spent by United States students. Japan is about one-half our size in population, but graduates twice as many scientists and engineers. In early 1960, the Japanese Government had linked education to national prosperity. In its national income-doubling plan of 1960, it said, "Economic competition among nations is a technical

competition." Japan achieved its ten-year goal in seven years. Expectations on the part of students, families and schools seem to be much higher than ours. The Japanese expect more from their educational systems, and they are willing to work for it. 90% of American mothers rated the schools of their children as excellent or good. In contrast, only 40% of Japanese parents rated their schools good or above.

At a recent NASA Contractor Conference, Barbara Morgan, NASA's next Teacher In Space, noted, "Help education and it will help you. In school, we call it sharing. Bring teachers into the work place, show them what you're doing. They will teach better and you will receive better people." Ms. Morgan also emphasized the importance of setting a standard for excellence, hard work, high standards, and involvement. NASA recognizes that creative and talented people are its greatest resource. They provide a continuous source of innovative concepts which lead to productivity and quality improvements. Of course, this concept of an educated work force is not exclusive to NASA. It is the issue that is critical to the nation and is the reason we are here today.

As a matter of record, this is the third time NASA's Offices of Productivity and Education have joined forces. The Howard County Project, from February through May 1985 was the first time. This project was conceived as an effort to bring to the elementary school level a good and workable technique in problem solving and team cooperation while enhancing standard school curriculums. The project stressed process. The teaching units can be applied to a variety of classroom subject matter. The positive results of the pilot support the concept that children can be taught how to work together to solve problems. I'm sure the NASA Education Programs Office has plans to expand this pilot.

The second joint effort was the Cocoa Beach Meeting of April 1986. Representatives from twenty companies, NASA's Education Office, and Productivity Office. Three Teachers in Space also attended. The following list highlights some of the major conclusions from the meeting.

- Target major education issues for action
- NASA/aerospace industry groups must meet again to identify and define educational problems
- Identify measures to indicate progress
- Establish ongoing relationship between aerospace industry and NASA education officers and field centers
- Seek ways to work with federal, state, and local governments to improve education in schools
- Each participating company should provide a one to two page report outlining their education initiatives and provide to NASA for discussion at subsequent sessions

I have read the reports from participating companies; they are impressive and will be shared with you during the conference.

The third effort, but not the last, is the present meeting. Our challenge now, is to identify and define the educational problems to be addressed and to take action to solve them. I cannot stress too strongly the need to generate a definite plan for action. With determined effort and applied knowledge, I believe we can make a real impact on the future work force of America. We will need the support and participation of every one of you. I believe the goal is attainable, and I challenge you to develop the next steps--the steps that will help America maintain its rightful place as a leader in the world's marketplace.

GODDARD WELCOME AND COMMENTS

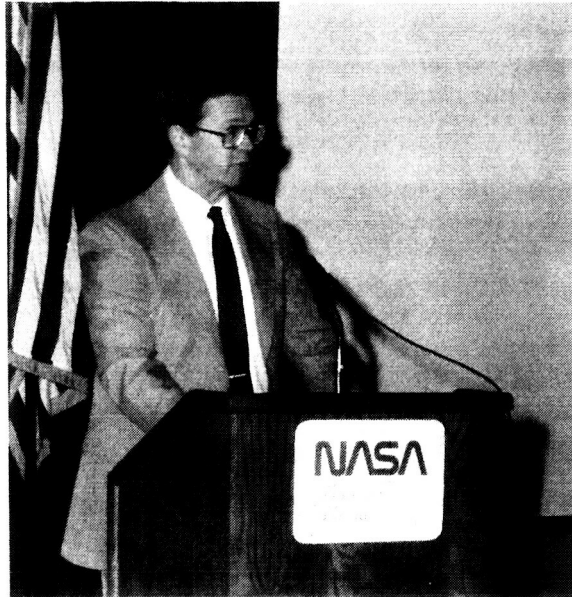
Introduction of Dr. Noel Hinners

BAILEY: Dr. Noel Hinners came to NASA in 1972. Before joining NASA, he served as Department Head of Lunar Exploration at Bellcomm. His first position at NASA was Director of Lunar Programs in the Office of Space Science, and from 1974 to 1979 he was Associate Administrator for Science at NASA Headquarters. He left NASA to become Director of the National Air and Space Museum of the Smithsonian Institution in 1979, but returned in 1982 to become Director of Goddard Space Flight Center.

Dr. Hinners earned a B.S. Degree from Rutgers University, an M.S. Degree from Cal Tech, and a Ph.D. from Princeton University in geology and geochemistry. He graduated with honors from all these institutions and was elected to Phi Beta Kappa. He received NASA's Exceptional Achievement Award in 1971, and has three times been awarded NASA's Distinguished Service Medal. He is a member of the American Academy for the Advancement of Science and President of the Planetology Section of the American Geophysical Union. He has a deep interest in pre-college education, which is the primary thrust of this two-day conference. It is my pleasure to introduce Dr. Noel Hinners.

GODDARD WELCOME AND COMMENTS

Dr. Noel W. Hinners
Director
NASA Goddard Space Flight Center



HINNERS: Thank you.

I welcome all of you. I enjoy speaking with educators, and with people from industry and other government agencies who are genuinely interested in improving the state of education in the United States. Goddard is very proud to be hosting this conference.

NASA and Goddard both have a stake in the future work force. We are firmly convinced that a healthy U.S. economy depends on a technically trained superior work force. We are firmly convinced also that a healthy economy relates very directly to a healthy civilian U.S. Space Program. We have a vested interest in what you are doing here today. About half of Goddard's 3,600 civil employees are scientists and engineers. However, many of our technical and administrative people are now eligible to retire or will be eligible to retire in the next few years. We need continuing replenishment.

Every organization needs new blood. It is essential to stimulate innovation and creativity. The further one gets from the classroom, the further one gets from school, the staler you tend to become. It's just an inevitable fact of life. Student visits to Goddard are one of the most stimulating ways we have of keeping our work force active and creative. Students ask questions. They are not embarrassed to ask the "dumb question."

We've seen that by the time students get to college, or even sometimes high school, it's almost too late to encourage them to get the right background to go into the scientific and technical fields. We must start in the elementary schools, and perhaps even earlier, to convince them that being well grounded in the basics is essential if they want the opportunity to make the choice to go into scientific and engineering fields.

The partnership of NASA, industry, and educational institutions is essential. We are dependent on the educational institutions and industry for help. Partnerships do bring more to the plate, if you will, than individuals working alone. There is a synergism in a partnership, a common goal that stimulates all to produce more than any individual group or organization can. The educational institutions, of course, are where the action is. You have to let us know where we can help you, how we can bring our people and equipment resources to aid in the educational process. Industry has some very special talents it can also contribute by supplying training and equipment.

Is there something behind the fact that NASA enjoys participating in the educational process beyond our need for skilled people in the future? Yes! We fancy ourselves, a special kind of educational institution. The goal of NASA is very simple, very basic; to increase the wealth of human knowledge and to share that wealth with everybody in the world. Fancying ourselves as educators, then, we are very much interested in how to get information to the people who want and need it. We are convinced that we can bring something special to the educational community. There is a thrill in exploration and discovery in the Space Program that can stimulate children and teachers alike. There is no lack of ways to incorporate space exploration and research into curricula--in mathematics, physics, art, history, poetry.

Don't forget the non-scientist and engineer. I fully understand and appreciate the need to stimulate our good students to go into science and engineering. But we also need some of our good students to go into technician fields, and into the arts and humanities. We have a desperate shortage of technicians. One doesn't have to look too far in the schools to see that there are many students who are very good with their hands. We need those students. We need to stimulate them; they too can have an exciting future, particularly, we think, in the space program.

In regard to productivity and quality, I urge you to consider all parts of the problem. Yes, U.S. productivity can improve. Better scientists and engineers will help. But management is also part of the problem. I have just read yet another analysis of productivity. Indeed, in 1985 the number of executives and managers by one count grew 5.6%, which is double the increase in GNP. From 1975 to 1985, the number of accountants grew from 1 million to 1.3 million. Industry is beginning to cut back layers of management. So, as we emphasize the need for increased scientific and engineering personnel, let us also discuss the need for lean management and to teach students how to become good managers. We tend to ignore that in our educational system. About one out of five or six people will become some kind of manager, and management skills and techniques should be part of this education.

In summarizing, I'm delighted to have you here. Today's partnership is one of which I think we can all be proud. Welcome to Goddard.

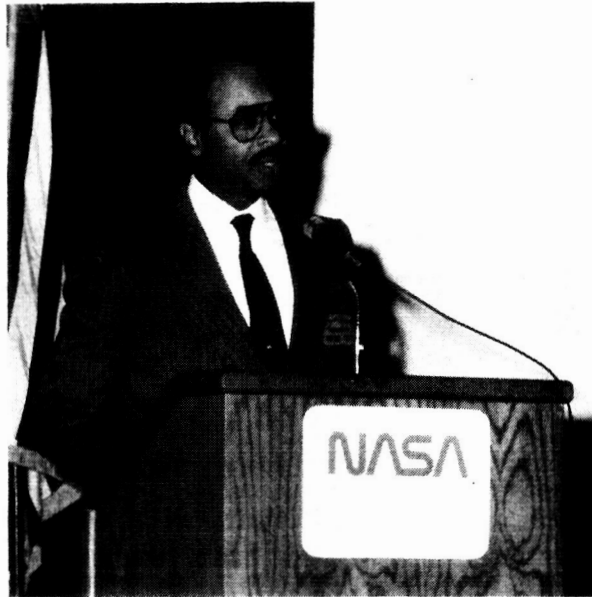
NASA WELCOME AND OVERVIEW-THE EDUCATIONAL PERSPECTIVE

Introduction of Dr. Robert W. Brown

BAILEY: Thank you, Dr. Hinners. I would now like to introduce Dr. Robert Brown. Dr. Brown is the Director of NASA's Educational Affairs Division at NASA Headquarters; he heads the educational activities for the agency and has at each of the field centers a small educational group that supports the national programs. Dr. Brown has a B.A. from Lincoln University in Missouri, an M.A. from Atlanta University, and a Doctorate in Public Administration from the University of Southern California. He has 25 years of experience in the Federal Government at various agencies: the Veterans Administration, the Department of Health and Human Services, the Office of Economic Opportunity, and the Office of Personnel Management. He has also been the Associate Dean for Academic Programs of the Federal Executive Institute. Dr. Brown joined NASA in February 1986.

NASA WELCOME AND OVERVIEW-THE EDUCATIONAL PERSPECTIVE

Dr. Robert W. Brown
Director
NASA Educational Affairs Division
NASA Headquarters



BROWN: Thank you. Its a pleasure to be here at Goddard.

Dade County, Florida, hires about 2,000 teachers a year and loses about 600 teachers a year. That situation is replicated around the country. In fact, some of the people who study demographic trends, personnel trends, and the like, indicate that during the next decade we're going to have a shortage of over a million teachers. That's a serious problem. A partnership between the American Can Company and the American Federation of Teachers (AFT) has been formed to try to do something about that problem. The American Can Company awarded AFT over \$100,000 to conduct a pilot program in seven of the largest school systems around the country. They are trying to recruit good quality college graduates with degrees in the social sciences, natural sciences, and a variety of other areas: people who had not intended to teach but who have the prerequisites for teaching and who might be induced to enter the field. This is to be done in a collaborative partnership with universities and under the tutelage of experienced teachers. This program will not only bring in people who may not have chosen initially to go into education, but will also provide a new career opportunity for experienced teachers. They will continue to teach, but these experienced teachers will also function as mentors. It's a very interesting and potentially constructive type of partnership.

One could say, "Well, I can understand why the American Federation of Teachers is involved in this project. . . they represent teachers. It makes good sense. But why the American Can Company? Why are they doing this?" Mr. Woodside, Chairman of American Can Company, has said, "The American business community has a vested interest in the quality of public education, for today's students represent the work force of tomorrow." That's the theme of this conference--the future work force.

As I look back over recent years at the various studies that have been done, their findings and the kind of message that is being conveyed with respect to education and increased private sector, congressional, and governmental concern, I think we're on the verge of a renaissance in education. The National Science Teachers Association each year produces some very illuminating findings about the health of science education in this country. The Business and Higher Education Forum this year has come out with a very reflective and thoughtful report on educational requirements in this country. The National Commission on Space has indicated where we ought to be going in terms of this country's space policy, and addresses the educational requirements that this country faces. The Carnegie Foundation has just completed a classic study on teaching as a profession.

Another effort pointing to the growing focus on education is that of the National Education Association, which commissioned a Gallop poll this year to study teachers and teacher training. In a telephone survey, they contacted 1,500 people from the general public as well as 1,500 teachers active in the profession. Let me share with you what that survey indicated, with an error of no more than plus or minus 3%. The results do not fully comport with Joyce Jarrett's observation about the Japanese and their respect for education, with the inference that in this country we do not respect education to the same degree. The findings of this survey are illuminating. The respondents were asked how they would rank fields or professions in terms of their contribution to the good of society. Here is how they responded. Teachers were ranked number one; engineers were ranked number two; pharmacists, three; airline pilots, four; hospital administrators, five; computer systems analysts, six; accountants, seven; newspaper editors, eight; and bus drivers, ninth. (There are some teachers who are driving buses.) Another finding was a very strong agreement between the teachers and the general public on the characteristics of a good teacher: ability to communicate knowledge to students; ability to motivate students to learn; mastery of the subject matter taught; concern for students' well being; excellent verbal and mathematical skills; and, the teachers added, accommodating individual differences in learning ability. In addition, the study indicated that seven out of ten respondents said that prospective teachers should be required to complete a supervised student-teacher experience as well as pass a written test of subject matter and professional skills and a classroom performance test conducted by a trained evaluator. So the public and the teachers do not want any less in terms of quality. In addition, 59% of the respondents favored raising teacher salaries even if it meant raising taxes. They recommended a salary of \$20,700 a year for a beginning teacher. The median current starting salary is around \$16,000 a year. They also recommended a salary of \$31,400 for experienced teachers; currently it is about \$25,000. The results of this study indicate increased respect for the field of education, and teaching in particular.

As Dr. Hinners indicated, we at NASA are sometimes asked why we are in the education business; since NASA is a high technology agency. As Dr. Hinners said, the development of and the investment in creating scientific knowledge is part of our charge. Part of NASA's mandate is to provide the widest and most appropriate dissemination of the results of our research and technology.

The general public has ownership of what NASA is about. We were reminded of that in a rather tragic way after the Challenger accident in January 1986. We found, from the outpouring of citizens and organizations throughout this country, and around the world, that people feel a sense of ownership about the space

program. We have an obligation to respond to that by disseminating appropriate information through our education forum and in an educational format. We want to use the existing and emerging technology of the agency as a catalyst to encourage students to consider careers in science, math, and technology, and as Dr. Hinnens indicated, in the other disciplines as well.

As we contemplate the time when humans will live in space on a long term basis, perhaps even permanently, we must consider the context. We're talking about taking a civilization, a culture, into space. I cannot conceive of any field or discipline that we're currently using on Earth that would not be applicable to a permanent presence in space. Thus, while we stress the technical areas of science and math and the like, we're concerned about the other disciplines as well. We use the term "multidisciplinary approach to education." We want young people to see the opportunities of the future so that they can prepare themselves. Space exploration, for example, includes Earth observations in terms of the role that satellites play in monitoring natural resources, air and sea pollution, volcanic activities, and underproduction or overproduction of global food supplies. In fact, we will participate in a World Food Day Program for which we will make a presentation on how space technology has contributed to the development and conservation of food supplies in this country. The Space Station will be very important in terms of preparing us for a long-term and permanent presence in space, and there is a whole body of scientific research relating to the Space Station that can be converted into intellectually stimulating educational materials, including the Space Telescope, and robotics. We want to use this technology as a catalyst in the field of education, and we want to do that in partnership with the business community and the educational community, as reflected in this audience today.

With our Educational Affairs Program at Headquarters and in the field centers around the country, as Mr. Bailey has indicated, we're embarking upon a long-range educational affairs action plan. We call it an Agenda for Action. We're thinking not only about what we're going to do now, but also what we're going to do in the future. We're modestly talking about a five-year plan, and we want you to be our partners in that process.

PARTNERING REALLY WORKS

Introduction of Dr. Frank Driscoll

BAILEY: Dr. Francis Driscoll earned a bachelor's degree from St. Michaels College, a Master's Degree from Harvard University, and a doctorate from the University of Massachusetts. He has been a secondary school teacher, a secondary school coach, a vice principal, a high school principal, and the superintendent of three public school systems. He is currently superintendent of schools in Oxford, Massachusetts. He has found time to be an instructor, an associate professor, and an adjunct professor in four institutions of higher education. His special achievements include the establishment in 1965 of the Talcott Mountain Science Center, which has since acquired a national reputation; the development of the Avon, Conn. Rare and Exotic Languages Center featuring the teaching of Chinese, Japanese, and Russian languages to secondary school students in 27 public, private, and parochial school systems; the establishment of a French teaching center in Oxford in 1979 to serve the educational needs of 35,000 students and 1,200 teachers in southern Worcester County. He received a presidential citation in October 1982 for private sector initiatives. He received the Governor's Award in September 1984 for implementing creative innovative educational programs. He served on the Governor's Commission on Education Reform during the 1984-85 school year. It's my special pleasure to present Dr. Driscoll to you.

PARTNERING REALLY WORKS

Dr. Frank Driscoll
Superintendent of Schools
Oxford, Massachusetts



DRISCOLL: Thank you very much, Mr. Bailey.

My assignment today is to discuss the partnership of education and the private sector. The Town of Oxford and its public schools have a full partnership with Digital Equipment Corporation in Maynard, Massachusetts. Digital is the second largest manufacturer of computer hardware in the world, and its corporate headquarters are located in Maynard. They have a number of factories and other installations in Massachusetts, southern New Hampshire, and 27 countries throughout the world.

What's interesting about this full partnership is that Oxford is not a Digital Corporation high-density community. The partnership began several years ago; at that time we did not have one Digital employee residing in our community and the nearest Digital facility was 54 miles away. This is an important point in the issue of partnering: it isn't necessary for the corporate partner to be a neighbor or even in the immediate area. Nor does the industrial partner have to be in computer technology. Digital happens to be one of the largest employers in the Commonwealth of Massachusetts. Digital employs 27,000 people in Massachusetts and is thus a substantial part of the economic base of the Commonwealth.

The partnership began a decade ago; we had taken on the objective of educating difficult high school students;--disaffected, alienated, secondary school youngsters. They represent the bottom 10 to 20% of youngsters on the high school level. They are the kind of youngsters who have never been educated well or adequately anywhere in the nation.

We focused on the really difficult youngsters, the kind of youngsters nobody wants. The schools don't want them; their parents don't want them; the stores downtown don't want them. There have been only one or two instances in the history of modern education in which educators have been successful in educating these youngsters, and success was not long lasting.

Thus, we did know some things about beginning with these youngsters. We had to provide them with some kind of work experiences, and obviously this could not be done in the public schools. Therefore, we contacted one of the major computer manufacturers in Massachusetts. We contacted their highest level education officer listed in their annual report and inquired if there was some way they could help us. The first contact we made was with Prime, which had nothing to offer our students or instructors.

However, we developed some knowledge and understanding of the corporate world. We learned that the corporate world expected the educators to know themselves, their needs, what they wished to achieve, and be able to answer the question, have you exhausted every self-help possibility?

Our second contact was with Digital Equipment Corporation of Maynard, Massachusetts. We met with their Vice President of Educational Affairs. I think our honesty in admitting our ignorance of computer technology, not knowing where to go, where to begin, how to get underway, was somewhat persuasive, and they decided to lend us a helping hand.

We were trying to work out soldering internships for youngsters and training for teachers. Our teachers were teaching soldering techniques that were 20 to 30 years out of date, and they didn't have the right equipment. Digital arranged for these teachers to spend a full week in a Digital plant learning new soldering techniques. They not only taught the teachers new soldering techniques but also made sure that the soldering equipment would follow the teachers back to our schools so that equipment as well as skills would be available to students. That is how our industrial partnership began.

We are a small public school district with about 2400 youngsters. The population of Oxford is 11,000. It is a poor, working class community in central Massachusetts, and it had nothing to attract this kind of industrial partnership. One of our early steps was to join with three other school districts in the partnership effort.

The partnership now provides opportunities for teachers and youngsters in a number of computer technology programs. Some of the programs are immensely successful. Our faculty over the last five years have visited 33 states to explain our programs. We've had visitors from several foreign countries visit us. A great deal of this happened as a result of the National Diffusion Network, U.S. Office of Education. Through their process of validation, approved by the Joint Dissemination Review Panel, a subdivision of the U.S. Department of Education, our programs, in a sense, bear the seal of approval of the United States Government.

It's one thing to say we have a wonderful program, and it really works. It's quite another thing to be able to prove it statistically. It is the approval of the National Commission on Excellence in Education that has helped immensely in

establishing our credentials and expanding our partnerships with Digital. Our partnership is not limited to one corporation. We deal with forty different businesses or corporations in terms of providing one type of help or another for our young people.

Project COFFEE, the computer technology program's acronym, stands for Cooperative Federation for Educational Experience. It has been nationally validated by the National Diffusion Network.

Some of what we have learned in the partnership, we originally learned from NASA. For example, the teaching of teachers through the medium of seminars or workshops possesses an innate shortcoming: once the seminars or workshops are over the teacher has no follow-up advice or assistance. NASA programs under the direction of Elva Bailey have had contact people available following workshops for those teachers and administrators who required or sought additional assistance. Merely to have personnel available to answer the question "How am I doing?" can be very important.

In our partnership with Digital we have insisted from the beginning that follow-up arrangements always be available for our teachers and administrators upon the completion of any length of study. In addition, we have arranged for at least one student to accompany each teacher who participates in any learning experience provided by Digital. Thus each teacher has someone "back home" to discuss what they have learned upon their return from the Digital experience. We have learned that students and teachers can share learning experiences, and both are stronger and better for it.

Project 50/50 is another project that we have developed with Digital Equipment Corporation. In 1986, Project 50/50 was nationally validated by the National Diffusion Network. This is a summer camp program supported by corporate cash donations. Over the last four years Project 50/50, supported by Digital Equipment Corporation, has received over \$600,000 in cash. The camp offers two-week sessions for high school freshmen. During the first summer they become acquainted with robotics and computers. A teacher from their high school is with them during camp. During the school year the freshmen have one period of computer technology education experience per day. The following summer, the teacher and students return to the computer camp for two weeks. This experience is repeated for three summers. Each succeeding year the study advances to a higher computer technology level. The program has been so successful that it now includes students from 17 high schools throughout central Massachusetts.

In addition, as part of Project 50/50, twenty-five teachers from the southern part of the state have become computer experts through training programs provided by Digital. These teachers had no computer background prior to their participation in Project 50/50. Thus the 17 high schools each have at least one computer teacher expert. This program is a Lighthouse Technology Model Program, funded in part by the U.S. Office of Education over the past 4 years.

A third computer technology program co-sponsored by Digital is the Computer Bus. The Computer Bus contains seven desk-top microcomputers and a printer. The Computer Bus goes from school to school. We encourage the participating schools to select 8th grade students for the Computer Bus program, as the eighth grade is the year of decision thinking. Most schools do make it

available for 8th graders. It's a very low cost program. In the first year of the program, we sent the bus to a junior high school. The 8th grade youngsters came out of their classrooms and were taught computer literacy on the bus. At the end of the week the bus departed and that was the end of the program.

We learned that we stimulated the youngsters, had them all excited, then departed. We learned that we had to train the teachers; and provide computer equipment for participating schools. Over the last four years, for the Computer Bus program, Digital has made computer equipment available worth in excess of \$3 million to the school districts of Worcester County. The process is as follows: as soon as the school district agrees to participate in the Computer Bus program, Digital provides five desk-top microcomputers, a printer, and five software packages. The school district's responsibility is to send at least two teachers to Oxford to be trained in computer literacy. We train them on whatever type of computer that Digital is making available that year. We teach the teachers how to assemble the computers and how they function. The Computer Bus now remains at each school for a month. In addition to training the students during the regular school day, we train at least three teachers from the school in computer technology in education. Thus, each student receives twenty periods of computer instruction. At least three staff members, during the month, complete an approved 37 1/2 hour graduate-level course in computer technology education. Finally, when the Computer Bus departs it leaves behind five desk-top computers, a printer, and at least five packages of software. Now when the bus leaves at the end of the month, the teachers have been trained, the youngsters have begun their study of computers, and the school district has the equipment and the materials as well as the software. The Computer Bus program is one we'd like to have validated by the National Diffusion Network. Unfortunately, it just doesn't lend itself to validation as the period of instruction is so brief.

The voters in Massachusetts, in 1980, voted for a referendum limiting the ability of the community to tax itself. It bent us out of fiscal shape, as Oxford's annual school budget in 1986-87 is \$1,100,000 less than it was in 1980-81! As a result, thousands of teachers have lost their jobs. We established a training program through Digital to train those teachers in the Cobol computer language to make them junior programmers. We borrowed the syllabus from Worcester Polytech Institute located in Worcester. Their course in Cobol for junior programmers is a one-year, 400-hour training program, and their instructor became our advisor. Worcester Polytech made available two graduate students to teach the class. Thirty-four teachers completed it. At the end of the training program, 17 of the 34 teachers were hired as junior programmers, and most of them have stayed in the programming field. Seventeen teachers returned to their teaching positions. Unfortunately, we did not follow-up on the teachers who returned to classroom assignment to find out whether their teaching techniques changed.

It is interesting that the 17 teachers who entered the business world as junior programmers were not math and science teachers. The outstanding Cobol language students were elementary school teachers, art teachers, and music teachers. We had expected something quite different.

Let me close the way I opened, in terms of partnership. The partnership of Digital Equipment Corporation and the small public school district of Oxford, Massachusetts, is now five years old, and Digital has contributed to it in excess of \$7 million. Much of that money is what we call "pass through money." For

example, the Computer Bus program has provided over \$2 million dollars of equipment to the participating schools. In retrospect, the partnership has made possible computer training for thousands and thousands of students throughout Worcester County. Youngsters have gone on to major in computer technology in education as a result of this partnership. It has been immensely successful in every respect.

In terms of identifying the characteristics for the success of the partnership, I will say to the people in education, listen. The vocabulary of the corporate world is different from yours. Don't be overly demanding in your requests with your corporate manager; don't enter with a wish list when you go to the first session. When they say no to you, think and try to understand why they said no. Remember that they said no to us many times. Examine their decisions so you can determine whether there are alternative ways of achieving your goal. Don't think that because you have achieved partnership with a corporate giant, you can forget the essential steps for maintaining a relationship. Always consider whether you have exhausted all avenues of help prior to seeking assistance from your partner.

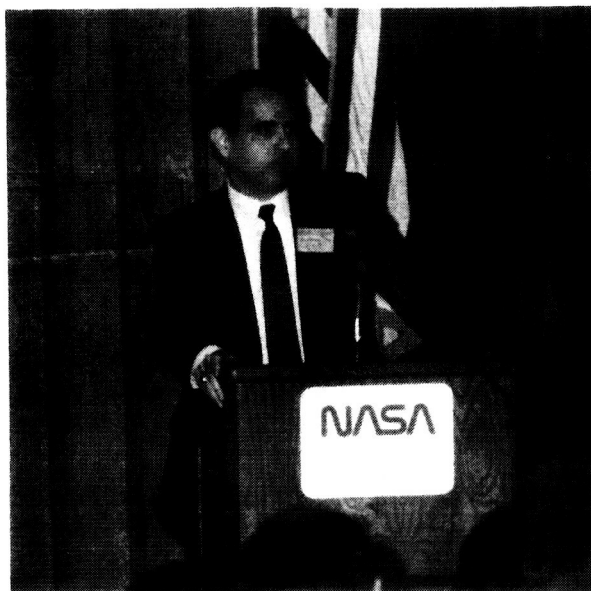
HOW BUSINESS HAS RESPONDED

Introduction of Dr. Walter J. Culver

BOYLE: Prior to joining the Computer Sciences Corporation in 1968, Dr. Culver was with Westinghouse Defense Space Center. He joined CSC as a Senior Technical Advisor on NASA programs and then directed software engineering for the Navy's Fleet Defense Missile System, AEGIS. In 1977 he became president of the newly formed Defense System Division of CSC. Then, in 1984, Dr. Culver assumed his current position as president of the Systems Division of CSC. This division provides turnkey systems and systems engineering and integration services in computer-based systems and communication systems. Dr. Culver has an electrical engineering and mathematics degree from the University of Detroit, and a Master's in electrical engineering and a Ph.D. in systems from Case Western Reserve. Dr. Walter Culver.

HOW BUSINESS HAS RESPONDED

Dr. Walter J. Culver
President, Systems Division
Computer Sciences Corporation



CULVER: Ladies and gentleman, good morning. I will endeavor to describe briefly the organized private-sector initiative--that is, the steady-state role of business in the school system of Fairfax County, Virginia.

The business engine in Fairfax County is a private non-profit foundation started just three years ago, which is dedicated entirely to supporting the primary and secondary educational needs of the community. Its formal name is the Fairfax County Public Schools Education Foundation.

I am a volunteer trustee of the Foundation, and its elected president. I would like to speak to you from multiple points of view. I am also a pragmatic business executive who has to preside over all the violent verbs of the profession: PENETRATE new markets; BEAT the competition; CUT the overhead. Finally, I am a father, sometimes concerned that the development of my children into adult human beings has been entirely indifferent to my perfectly reasoned nagging.

My observations are those of a community volunteer--more explicitly, the chief elected officer of the Fairfax County Public School's Education Foundation.

To put my observations in context, you have to understand a little about Fairfax County. It is big--it has 700,000 people, 126,000 public school students, 13,600 full-time school employees, and 8,400 teachers.

It is affluent-- the median family income is \$54,000 per year; 1986 school budget is \$630 million.

It is smart--the public schools have a 2% student dropout rate; students fall in the 80th percentile in mathematics, and no worse than the 68th percentile in other subjects. 87% of the students continue their education after high school.

Understandably, the public schools do not need business to tell the schools how to educate or how to administer. The public school system can attract talented employees to do that. But business can and does have an important role. Many things in education, or indeed, in local government departments in general, are hard to get done within "The System." The Foundation was formed to serve the superintendent of schools in the areas in which "The System" does not respond well.

The Foundation's mission is to provide expertise, funds, and equipment for those projects deemed critical by the county school system, but for which government resources cannot be obtained in a timely manner.

Our first project, the birthing force of the Foundation, was the Thomas Jefferson High School of Science and Technology, in Annandale, Virginia. The goal set for the school was to be the nation's preeminent Magnet High School for the Sciences. Fundamental to the concept was the providing of equipment and curriculum-development expertise associated with ten laboratories in the school, including a microelectronics laboratory, a communications laboratory equipped with satellite ground stations, and a chemical-analysis laboratory prototypical of our finest chemical research facilities.

Twenty-nine companies in Fairfax County came together to staff a Board of Trustees for the Foundation in 1983, supported by just two full-time Foundation employees. Each of the trustee companies decided to pay an administrative fee to ensure that 100% of all donations goes to our projects, with no administrative tax. By September 1985, nearly \$1.5 million in cash and equipment was raised, and the high school opened with a freshman class of 400 and a smaller senior class, with five of the ten laboratories fully operational. The remaining five are opening this year, with a comparable business investment. The 29 companies marshalled a hundred others not in the Foundation to help. Major Federal Government organizations, most notably the Night Vision Laboratory at Ft. Belvoir, also stepped forward.

As just one early measure of the school's performance, more full college scholarships were offered to last June's graduating class than the school had graduates. As another measure, I had the privilege of briefing President Reagan at the school in February about the role of business in the program.

Elsewhere in the school system, we have provided computer-assisted devices so that students with severe physical handicaps can interact with the world around them--perhaps by nothing more than eye movements--to learn, contribute, and gain dignity.

Perhaps our most ambitious program is our most recent one. It is called AIMS (Alliance for Increasing Minority Success). It was brought to the Foundation jointly by the Virginia Polytechnic Institute and State University (Virginia Tech or VPI) and the public school system. It focuses on the school district within the county with the least affluence, the highest dropout rate, and a virtual zero success rate in graduating public school students from college with degrees in science and engineering.

The concept is to capture the intellect and imagination of promising minority students as they enter the eighth grade, guide them through the next five years of school to prepare them for a high-technology curriculum in college, and to ensure that no one is excluded from college only because he or she lacks the money or family guidance.

This year the school system has chosen 30 students and will chose 30 more each year. Virginia Tech will provide partial scholarships and grant them letters of admission as they enter eighth grade; the only condition is satisfactory academic performance over the next five years. The Foundation will introduce these students to firms that will provide part-time jobs to earn money toward college, with mentor employees acting in a "Big Brother" fashion. Of the first group of 30 students, only one had a parent who had attended college.

The Foundation will also establish an endowment fund, estimated at about \$2.5 million, to cover the college expenses not covered by other means. Sallie Mae came forward with the first contribution to this fund, a \$10,000 check for the first 30 students. CSC matched it with our own \$10,000 check.

Will it work? We will have to wait nine years to see the first college graduate. But in looking into the eyes of those 30 children when I spoke to them this past spring about the community's commitment to them--and seeing there the enthusiasm and receptiveness of people too young to be imbued with the expectation that they must fail because of skin and family circumstance--I have no doubt at all about the outcome.

But let me speak for a moment as a businessman. As seen by the stock holders of Computer Sciences Corporation, is it a proper investment of my time and my company's financial donations to support the Foundation? I can almost dismiss the question as having a self-evident answer. As just one example, prospective hires or prospective transfers have among their important concerns the quality of the school system and the vitality of the community. Those two concerns are inevitably intertwined. One would be hard-pressed to find in history a society which was not superbly educated that long survived environmental changes. In this country, look at the plight of the steel worker, oil worker, and auto worker communities, as compared to those that have benefited by the millions of new service jobs created for the well-educated communities.

Finally, let me speak as a father, and as a son of a father. The Great American Dream has always been based on our ability to reach for opportunity unfettered by preassigned distinctions of rank and birth. Once the opportunity lay in undeveloped American territory. But in most of this century, it lay in education. I was born into moderate means to parents with first-generation roots, surrounded in New York City by children also born into moderate means and of first or second-generation Americans. The way up, for all of us, was through educational excellence. That much my children absorbed from me, and that, I would guess, holds also for most of you and your children.

For us to fail to step forward in communities where business and Federal Government organizations have the leverage to do so would be, in my mind, nothing less than a denial of our heritage.

These are the trustees of the the Fairfax County Public Schools Education Foundation for 1985/1986:

Advanced Technology Incorporated (High Technology)
Ted Britt Ford Sales, Incorporated (Automobile Retailing)
Sky Courier Network (Nationwide Express Delivery)
Arthur Anderson and Company (Big 8 Accounting Firm)
VM Software, Incorporated (High Technology)
Computer Sciences Corporation (High Technology)
Davis and Carter (Architects)
A. J. Dwoskin & Associates (Real Estate Management)
Sovran Bank (Finance)
Hazel and Peterson (Real Estate Development)
Peat, Marwick, Mitchell and Company (Big 8 Accounting Firm)
Koons of Manassas (Automobile Retailing)
The Irving Group (Real Estate Investment)
Honeywell, Incorporated (High Technology)
TRW (High Technology)
Sallie Mae (Finance)
Virginia Power (Utility)
Mid-Atlantic Coca Cola (Retailing)
Gould, Inc. (High Technology)
Hazelton Laboratories, Inc. (High Technology)
Municipal Leasing Corporation (Finance)
Xerox Corporation (High Technology)
Lewis, Mitchell and Moore (Law)
AT&T Communications (High Technology)
TDX Systems (High Technology)
Atlantic Research Corporation (High Technology)
Boeing Computer Services (High Technology)
IBM (High Technology)
Georgetown University Hospital (Medicine)

THINGS THAT CAN BE DONE

Introduction of Mr. Lawrence A. Shulman

BOYLE: Now I'd like you to meet Lawrence Shulman. He's an attorney and the senior partner in a law firm of 27 people that specializes in real estate. Mr. Shulman is from Washington, D.C. He's been an active volunteer for many years in community service projects. He established the Montgomery County Students' Construction Trade Foundation in 1975. This non-profit group, through the cooperation of business and professional communities and the public schools, enabled vocational students to build houses and sell them. So far they've built 13 houses, including 3 which sold for more than \$200,000 each. In 1977, Larry established the Montgomery County Students' Automotive Trades Foundation. This extraordinary activity allows students to operate used car dealerships. They repair and they sell 100 automobiles a year. With these two triumphs behind him he went on to establish the Montgomery County Students' Retail Trades Foundation, which operates a student run flower shop called Classic Flowers in a local shopping center. Larry's fourth achievement is the Montgomery County Educational Connection Incorporated. It operates a resource data bank to link the needs of individual teachers with the resources of the business community. In recognition for these and other activities, and his avocation, in 1984 Mr. Shulman was appointed by Governor Hughes to the Maryland State Board of Education for a five-year term. At a White House luncheon in 1982 he received the President's Volunteer Action Award in honor of these unique contributions to the community. In January 1983 he was named Washingtonian of the Year by Washingtonian Magazine. Among other honors have been a citation from Governor Hughes, the Outstanding Volunteer Service Award from Montgomery County Public Schools, and the Montgomery County Education Association's Award for Outstanding Contributions to the Schools. He lives in Rockville, Maryland, with his wife and three children.

THINGS THAT CAN BE DONE

Mr. Lawrence A. Shulman, Esquire
Shulman, Rogers, Gandal,
Pordy and Ecker, P.A.



SHULMAN: I'm a strong, some people might say "passionate", believer in the natural partnership between the public schools and the private sector. That is why it is a tragic loss when the two fail to connect because neither knows how to approach the other, even though they might be the most willing partners in the world. Most of the good news you will be hearing today and tomorrow has to do with school-business partnerships. These programs have worked and are working.

I would like to be helpful in another way--to share with you some working principles, some universal truths that have come out of my own experience as a businessman working with the schools.

The first principle relates to the problem of the stand-off between two strangers who can make beautiful music together, but first someone must introduce them. I believe it is up to the private sector to take the initiative.

I first became involved in a school-business partnership in 1975. One of the vocational teachers in the Montgomery County Public Schools was trying to improve the educational program for construction trades students. Instead of teaching students in the laboratory, he wanted to teach them on the outside in a real-life situation. First, he had to convince his co-workers, his immediate supervisors, his next rung of superiors, and the Associate Superintendent of Schools. Then, he had to convince the Superintendent of Schools and the Board of Education. It took 2½ years to convince them that it made sense to put kids in a real-life situation.

Imagine students in a masonry class. The students work there for about 45 or 50 minutes, laying brick with water and sand. Ten minutes before the bell rings, the teacher says to tear it down, clean it up, and put it away for the next class. Now think about those same students working on a site in the heat and the

cold, in the sun, the rain, and the sleet with other students learning different trades. That doesn't sound like a radical idea, but it took 2½ years to get the idea through the school system.

When school officials finally approved the idea, they said, "Great, we approve it. You've got two teachers and a truck. Now go build a house."

Not very easy to do. But the teacher went to the business community. He went to the Bar Association, he went to the builder organizations, and he went to the accountant organizations and asked them for help. Eventually, he stumbled on to a few people--accountants, lawyers, builders, and subcontractors--who agreed to help. They created the Montgomery County Student Construction Trades Foundation. It only took a year before we built our first house.

A number of us involved in that project recognized that the same concept could apply to other areas--particularly the automotive area. I had a number of automotive dealer clients who continually complained to me about the lack of good mechanics. So I talked to them and pointed out that kids and cars make a lot of sense. Then I met with the Automotive Trade Association, the new car dealer organization, and the Superintendent of Schools. Our delegation suggested that the school and the business community set up foundation to operate a used car dealership. We would buy used cars and the students would fix up the engines and the bodies. We would get students to keep our books, and sell the cars. With the Superintendent's approval and in just a little over 6 months, we were operational.

We did the same thing when it came to forming a retail trades foundation. We went to the Superintendent, a different one by then, who suggested we go before the Board of Education. They approved it.

It's up to the private sector to take the initiative.

Educators who run these programs recognize that they have a lot of problems to deal with in running a large business. They have to set priorities. They don't have time to spend on problems. Instead they look to you and me in the business community to help solve those problems.

We have all heard of the problems. Some of the speakers this morning have talked about them. If you have a solution, offer it. Educators are interested in your ideas. They are willing to listen. And it is much easier for you to propose an idea at the top of the system than it is for a teacher to send it up, for a board member to get the other board members to go along, for a Superintendent to sell it to the Board, or for a principal to get the idea up the ladder.

Go to the Superintendent. Go to the Board of Education. Go to the top.

Suppose you wanted to sell a product and you hit a purchasing agent who said no. You knew the company really needed your product. Would you stop there? You would find a way to get to the top to demonstrate your product and convince the company that you had something they needed.

It's up to us in the private sector to take the initiative. Why shouldn't we take the initiative when we're talking about our kids in our community?

That leads to my second principle. If the private sector sets up a project, it must establish continuing lines of communication for that project, an ongoing dialog between the business community and the educational community.

We live in a system of networks. I network with people in the business community. I know some teachers who are members of neighborhood or civic groups, but I really don't have lines into the educational community. Likewise, members of the educational community don't network with people in the private sector. There are two separate networks, and we must find ways to put them together.

I think we have misconceptions that hinder our educators. When we in the private sector think about teachers, we think about their strikes, about their inflated salaries, or about their easy jobs. After all, they only work nine months a year. I only get three weeks vacation. Likewise, educators have misconceptions about the business community. They think that since we are profit oriented, we have no reason to be interested in education.

For a number of years, I have talked to educators in Montgomery County and have told them to talk to the business community--they're interested; they care. The response was skeptical. I have tried to convince educators that the business community is truly interested in education.

A number of years ago our County Executive invited 60 CEOs to a conference to talk about transportation, economic growth, and education. For one day, 20 CEOs talked about education in our community. A few of my friends in educational administration participated in those discussions. After that conference, one of the greatest educational skeptics acknowledged that the business community was really interested in education.

We operate two different networks under two different systems. We need to break down prejudices and false perceptions.

Another problem is that teachers are sometimes afraid to ask for help. We think that teachers know everything, that they know all the answers. Well, that's not so. And the business community doesn't know all the answers either. But teachers who have the responsibility of training our children are supposed to know it all. Teachers do need to ask for help, but often don't know who to ask.

Both the Montgomery County and (Fairfax County Construction Trades Foundations) operate with a Board of Directors. These boards meet monthly, offering an interchange between the officers and directors and the teachers. Builders make site visits to the project. This is not a hit or miss communication system. This is an ongoing continuous conversation that breaks down the barriers.

In a Construction Trades Foundation meeting recently, one of the contractors casually asked a teacher about how construction was going on the site. The teacher mentioned that he had been wrestling with putting up the roof trusses. The houses that students design in Montgomery County are very imaginative. This house had cathedral ceilings supported by a complicated roof truss structure. When they heard about the problem, two builders at the meeting suggested that they visit the site with their carpenters. Two days later two builders, five or six carpenters, one teacher, and 20 carpentry students put up the trusses.

The teacher didn't have a problem admitting he had a problem. He knew the business people on the foundation. He joked with them, talked to them and had a comfortable relationship with them.

My third principle is that if you work on a project with the school system, you must play by the rules of business. Many people who get involved in volunteer projects think there is another set of rules. Often a volunteer assumes that someone else is going to step in. Someone else will make it happen. We're just going to do our thing. But we know the business rules. We know what makes an organization run. We've got to get involved the way we're involved in our businesses.

Several years ago I was president of my synagogue. A number of people who preceded me as president were very successful business people, but when I took office, I found an organization with no fiscal controls, no budgetary planning, and no real administration--in fact, it had no planning at all. Those people who preceded me didn't run their volunteer project the way they ran their businesses.

It is important in formulating a project that you use familiar concepts and terminology. The four vocational trades projects in Montgomery County are all nonprofit corporations. They operate with a Board of Directors. A Board of Directors should have a maximum of 12 members.

The officers of the foundations--president, vice president, secretary-treasurer--are all from the business community. The exception is one person appointed by the Superintendent of Schools, who is generally elected by the Board of Directors as the Executive Vice President. This board member is the teacher in charge of running the project on a day-to-day basis.

These are all concepts that we are familiar with in the private sector. The business people who make up the board need to feel that they own the project, that they're responsible for its destiny. They are not just there to advise; they are there to participate and make things happen, just like in their own businesses.

As business people, we need to look at a project as a product or a service. We provide products and services in the private sector. Those are the things we know and things we can measure. Yes, we build houses in the Construction Trades Foundation and we rehabilitate used cars and sell them. Both activities create products, but what we are really doing is educating kids.

In the Educational Connection Project, we designed a computerized resource bank to match business volunteers and resources to the needs of the classroom teacher. We performed a service to teachers. By helping the teachers, we helped them to better teach kids.

It is not normal in the business community to ask people for money. If you have a product to sell, you don't go to your potential customer and ask for money. You convince them to buy your product or your service. Then they'll part with their money.

We want a project to be part of their lives. We want their time and their expertise, not their money. And we want every project to operate under business rules.

In approaching any project you need to use common sense. You need to start small. We always have grandiose plans about marketing a new project or a new service, but we also know that it doesn't make sense to spread ourselves too thin. We must be sure that the project is going to succeed. We can build on success. But if we spread ourselves too thin, by undertaking more than is possible, the project will fail.

Each idea should be evaluated. If you don't like an idea, you must be able to say no to the educational community. Explain why it won't work, why it doesn't make sense. Talk it out. And if you have an idea and you're turned down, argue for it.

A few years ago the Automotive Trades Foundation proposed a logical expansion of the car dealership. The teachers were behind us, but their superiors were skeptical. The further up the administrative ladder we went, the more skepticism we encountered. So we decided to go directly to the Board of Education at budget time and present our idea.

The President of the Automotive Trades Foundation in Montgomery County lives in Reston, Virginia, and has an automotive dealership in Washington, D.C. When he introduced himself to the Board of Education and said he was a resident of Virginia and worked in the District of Columbia the members were aghast. They didn't understand why he was there. Why was a Virginia resident and member of the District of Columbia business community with no connection in Montgomery County involved? But this businessman, as do many people in the business community, recognized that it is important to participate in such projects.

Did the Board of Education reverse the administrators' decision about expanding our program? They sure did. We sold it. We were not afraid to argue within the system for what we believed in.

It is important that business people do not try to run the school system. The last thing that any of us needs is to try to manage or operate a school system. Our function is only to support.

When we began the Construction Trades Foundation, I told my fellow board members that we needed a contract with the school system. As a lawyer, I think in terms of contracts. But the other board members were a lot smarter than I was. They convinced me that we didn't need a contract.

We're a resource to the school system. If the system breaches the contract, if they stop the program, we're not going to sue them. If they stop the program in the middle of the year, we'll find a way to finish the house. We'll pay the bank off. We don't need a contract. We can't tell them how to run the school system. If they don't need us, if they are not interested in what we're offering, we have plenty of other things to do.

There are no contracts between any of the Foundations and the school system.

It is not our responsibility to teach teachers. But we have found that teachers have learned from us indirectly.

Each year the Construction Trades Foundation has a competition. The students design a house to be built the following year. An architect, a builder, and a realtor meet and review the students' submissions.

The first year the selection team learned where each student lived because each designed his own house. The selection was difficult that first year because the plans had serious problems. In one plan, a visitor walking in the front door could see the dirty dishes in the sink. In another, you looked directly into a bathroom. Stairways on the first floor didn't connect with stairways on the second floor.

Five years into the program, the selection team was still having a tough time, but it was a different kind of a tough time. The problem then was picking the best plan because all were done well and were creative.

Why had the plans improved? This was a totally different group of students. That first year we were dealing with juniors and seniors who are now gone from the school system. The teachers were listening as educators, they weren't taught as educators to design houses. They learned from the selection team and didn't let their students make the same mistakes. They encouraged their students to be creative. As a result, the competition has gotten tougher and tougher.

People in the business community need to be participants in projects, not advisors. They need to contribute their ideas, their thoughts, their suggestions, and their arguments for or against. They need to feel that they are participating. Invite some of your friends in the business community to become involved. You will find that they are more interested in participating in a project than in being invited to advise.

I have emphasized four basic principles. First, take the initiative. Second, make sure you have on-going communication. Third, operate under business rules. Finally, use common sense.

As I look back on the numerous volunteer activities in which I have participated, I have found that in working with kids in partnership projects, things happen. You reap an immediate reward for your efforts.

Yes, I believe in the natural partnership between the public schools and the private sector. I also believe that if we give our imaginations free reign, our effectiveness will be as great as our creativity.

PANEL

Introduction of Dr. J. David Lockard

BAILEY: Dr. David Lockard is moderator for the panel of presenters in this morning's session.

Dr. Lockard is the Director of the International Clearing House on Science and Math Education, Curriculum Development Section, University of Maryland. He is a Professor of Botany and Science Teaching at the University of Maryland. He is a member of Epsilon Phi Epsilon, Gamma Sigma Delta, Kappa Phi Kappa, Phi Delta Kappa, Phi Kappa Phi, Phi Sigma, and Phi Sigma Chi. In 1985, he was recognized by the Pennsylvania State University as one of the key alumni and in May 1983, he was invited to the People's Republic of China to present workshops on science teaching for three weeks. Dr. Lockard has authored 18 books and edited 24 books. He has published 18 journal articles, and served as editor of the reviews published each month in the "Resources Review Section" of the two National Science Teachers Association magazines. He is a member of the following organizations: The American Association of Science, The American Association of University Professors, The American Institutes of Biological Sciences, The American Society of Plant Physiologists, Botany Society of America, International Council of Scientific Unions, Maryland Association of Biology Teachers, Maryland Association of Science Teachers, National Association of Biology Teachers, National Science Teachers Association, and Washington Academy of Sciences. He has been the faculty advisor for 127 graduate students who earned the Master's Degree and 52 graduate students who received a Ph.D. Dr. David Lockard.

PANEL

Moderator:

Dr. J. David Lockard
Professor of Science Teaching
University of Maryland



LOCKARD: I'd like to thank NASA and Goddard, for ongoing activities to support science education at all levels for many, many years. All of us owe a debt of gratitude, not only to NASA, but to all of their cooperative contractors.

QUESTION: In having students working on projects at actual work sites, what considerations had to be made concerning Child Labor Laws?

SHULMAN: There is an interesting story about the Child Labor Law. We did not worry about that; we were worried about Worker's Compensation. We don't pay students. It's regular course work for the student. But I was worried as a lawyer about Worker's Compensation. Did we need it? I called the Clerk in the Maryland State Worker's Compensation Commission and explained the situation to him. He told me to write a letter and he would send it to the Attorney General's Office in the State of Maryland. I wrote a letter and sent it to the Clerk. Two or three days later, I got a carbon copy of a letter from the Chairman of the Worker's Compensation Commission forwarding my letter to the Attorney General of the State of Maryland. The letter said that we had a fantastic project and offered the opinion that these students were not subject to Worker's Compensation. And if it is found that they are, draft some legislation exempting them because we think this is a super project.

QUESTION: How do you find the time and means to transport the students to their work site during the school day?

SHULMAN: If possible, locate the construction near a vocational school or wherever the schools may be. In Montgomery County, at the time, we didn't have vocational centers. So we had to bring students from a variety of schools. We had no money in the budget for bus drivers; buses were available but not bus drivers. There was a simple solution.

Teachers received bus driver licenses, and they brought the kids to the site. They'd take two class periods in their major, such as carpentry or masonry. They'd spend some of that time getting to the site and some of the time going back, but it gave them enough of an opportunity to work on the site. We had a school much further out where the teacher, the students, and the principal worked out a situation so that the students could get off a day a month to come down and work on the house and be a part of it.

QUESTION: What does the foundation do with the proceeds or income from the various projects?

SHULMAN: In some school systems, I've seen a charge for services that students are providing at a cut rate, and I think that's wrong. I think that money belongs to the students. The money that comes from selling the houses goes back into the Foundation. We charge a fair market value for houses. As a matter of fact, we auction them off, and when we were selling them in the private market, they always sold for significantly more than the appraised value. All that money went back into the Foundation. We didn't believe in giving money away. We felt it was important as business people that we invest that money. Yes, we gave some awards to the kids that were good students, and we gave them money to buy tools.

But there were other more creative kinds of things we accomplished. We needed school buses to get kids back and forth to the site. The state mandates the life of a school bus to be twelve years, but in Montgomery County, buses are only used for eight years. We bought used school buses from the County School System. Then we took them to our mini-dealership and had them repaired. We never took the titles out of the school system, and we gave the repaired buses back to the school system, which had agreed to maintain them. We also sent some teachers to the National Association of Home Builders Convention in Las Vegas. I don't think that giving the money away where one student will benefit is the answer. I think it's up to us to find creative ways.

QUESTION: The suggestion was made by Mr. Shulman to find ways to overlap the education and industry networks. Can you offer any suggestions?

CULVER: Well, there are a couple of mechanisms that come to mind. One of the programs that the Fairfax County Public School Education Foundation is supporting is a program called Impact Two. A relatively small amount of money, about \$50,000 a year, is used for travel and minor supplies. The Impact Two Program is to network teachers of all types, to give teachers a chance to meet in a central location to exchange ideas about teaching, about student direction, about curriculum development. The teachers are invigorated emotionally and

spiritually and return with ideas for their own school system. The teachers are chosen based upon merit. Impact Two is a nationwide program and it's one that industries, I think, can easily be approached to support because the funds are so nominal. That's one that comes to mind immediately.

SHULMAN: In the auto project, we wanted to get insurance for a garage to be run by students, and I called the largest garage keeper liability insurance company in the country. I explained to them that I wanted them to insure student mechanics. They refused. The Hartford Insurance Company, which insured the house project, understood what we were about, and gave us the insurance. You don't take no for an answer; you keep looking.

QUESTION: How do you suggest approaching industry to ask for funding? How do you find the right person?

SHULMAN: You shouldn't be looking to raise money. You should be looking for people who will give time and help to participate in developing a meaningful program. Basically, I'm talking about a product or a service. Once that is done, I think that you will find the money will follow.

CULVER: I second that. You find that comptrollers of companies, the ones who sign the checks you may be looking for, cannot identify with a theory, an idea, or a concept. That applies to foundation concepts of the type that we both talked about as well. We were able to argue easily to obtain funding for a minority program project, but not a foundation or a broad concept.

QUESTION: Is there a clearinghouse resource available to help locate the kinds of programs and grants available? Not all school systems are located in metropolitan, high technology areas.

SHULMAN: There is a foundation composed of foundations that exist in Washington, D.C. I believe it lists all the foundations and corporations that give away money, and what they are looking for in those kinds of projects. In Montgomery County, we're criticized. People have said that our projects work well because we are affluent. I don't think they work because we are affluent; I like to think that they work because we, who are in the business community in Fairfax, Montgomery, or Prince George's County, are involved. Say that you have three projects you'd like to do. Concentrate first on one. Fairfax or Montgomery because of their affluence could do three or five, but you should start small. There are limited resources.

QUESTION: How do you interest non-local, high technology industries in partnering?

SHULMAN: I don't know how you entice people who aren't in your community. You'd have to devise a program and use some of your contacts. You've got a product, and you've got to make it unique to sell it because everybody else out there is selling in the market, too.

CULVER: The only way out might be to try to use the political process.

MID AND LATE-CAREER CONVERSIONS

Introduction of Mr. Rob Traver, for Dr. Katherine Merseth

BROWN: Our first speaker this afternoon is Mr. Rob Traver from the Harvard School of Education. He is an Assistant to Dr. Merseth, who was scheduled to be our speaker this afternoon. Mr. Traver has an undergraduate degree in biology from Dartmouth, a Master's Degree in education from Purdue University, and a Master's Degree in natural resource management from the University of Canterbury in New Zealand. He is now a doctoral candidate in education at Harvard. He works very closely with Dr. Merseth.

MID AND LATE-CAREER CONVERSIONS

Mr. Rob Traver, for
Dr. Katherine Merseth
Director of Teacher Training
Harvard Graduate School of Education



TRAVER: The condition of American mathematics and science education at the secondary level has deteriorated significantly over the past twenty years. Both the numbers of students studying math and science, and the achievement levels of all but the very gifted as measured by SATs and the National Assessment of Educational Progress, have declined steadily since the early 1960s (1). This disturbing situation occurs at a time when industry's need for qualified workers with math and science backgrounds--from Ph.D. level senior scientists to high school educated technicians--is on the rise. Moreover, even those students who go on to non-technical careers often lack a minimum level of math and science competency required for non-quantitative jobs and daily living.

Federal commissions, state legislative task forces, private foundations, and individual scholars investigating these downward trends all stress the critical importance of the classroom teacher in the delivery of a quality education. Findings generated by such studies indicate that the current math/science education crisis is due, in significant part, to:

1. A critical shortage of entry-level teachers certified in physics, math and chemistry
2. Significant attrition among experienced math and science teachers who are leaving education for higher paying jobs or retirement.

The trickle of qualified secondary school math and science teachers entering the profession, and the flood of those leaving, have resulted in a frightening shortfall. In 1980, America's institutions of higher education produced 78% fewer math teachers and 64% fewer science teachers than they had in 1971(2). In 1982, 42 states (out of 45 responding) reported either a "critical shortage" or a "shortage" of mathematics and physics teachers (3).

Since 1982, this shortage has worsened. For example, the 49 teacher training institutions in Massachusetts produced two teachers certified to teach physics in 1983, while New Hampshire graduated one individual trained to teach mathematics. The popular press continues to draw attention to the shortfall: in 1984, the New York City schools were "short several thousand teachers as schools were about to open," and Georgia recruited West German teachers of math and science to fill vacant positions (4).

ECONOMIC, SOCIAL, AND DEMOGRAPHIC FACTORS

The decline in the number of entry-level mathematics and science teachers is the result of economic, social, and demographic forces. Young, capable college graduates with scientific ability find that their aptitudes and training are far better compensated in industry than in education. Starting salaries in the computer or banking industries for technically trained individuals are often between \$25,000 and \$30,000 while in 1984, the mean starting salary for new teachers with a master's degree in Massachusetts was \$15,409. Not only are starting salaries much lower, but opportunities to reach a high salary level after long service are non-existent in education. For example, the average salary of public school teachers with six year's experience and a master's degree in Massachusetts in 1984 was \$16,589 (5).

Negative economic and social conditions are exacerbated by demographic changes that will heavily influence the future production of math and science teachers; over the next dozen years there will be more than a 25% drop in the number of 18 to 25 year olds (6). Neither the pay differentials suggested by some to bridge the economic gap nor the laws enacted by many state legislatures to forgive undergraduate student loans for the study of scientific education address the fact that the traditional labor pool for new teachers--those who are in their early twenties--will decrease significantly over the next decade.

Additionally, the increased career opportunities now available to women have had an adverse impact on the supply of new teachers. Prior to 1970, women served as a "hidden subsidy" because teaching was one of the few professions accepting women. Since 1970, however, the percentage of women earning bachelor's degrees in education has dropped dramatically from 38% in 1970 to 17% in 1981 (7).

The flood of experienced teachers to non-education fields is also economically and socially based. In 1980, almost five times more science and mathematics teachers left their school systems to take non-teaching jobs than left due to retirement (8). And this trend will continue; a survey of mathematics and physics teachers in the Boston area indicated that within the next two years, six out of ten math teachers plan to leave teaching, while 13 out of 19 physics teachers hope to find non-teaching positions (9). In addition to the obvious economic advantages of such a career change, these professionals are leaving teaching because they believe that society does not value their contributions. In a 1984 Gallup Poll, teachers felt that the most crucial problem facing local public schools was the lack of parental support. Their beliefs are reinforced by low salaries and the general societal attitude that teachers are involved in little more than sophisticated childcare.

In addition to those leaving the profession to achieve social and economic enhancement in other fields, the supply of teachers will be decimated by retirements. Demographic data on the current teaching force suggest that over 25% of those who were teaching in 1980 will retire before 1990 (10). Taken together, retirements and job changes cause labor economists to predict the need for 300,000 to 1,000,000 new teachers by 1990 (11).

In addition to a serious shortage of teachers, very few current or aspiring classroom teachers from traditional programs have experience in applications of mathematics and science. These individuals must rely on teachers' manuals and other commercial materials to convey the usefulness of the subjects. While many teachers' in-service training opportunities were available for math and science teachers in the 1960s to update and develop subject matter knowledge and skills, fewer opportunities have been available recently. As a result, more than half of the current science teaching force have not attended an in-service workshop or professional meeting in the last ten years (12). In classrooms, this weak link to realistic applications leaves most students with little sense of the relevance of the materials or the excitement of the scientific method.

The response of higher education institutions to these problems of a diminished supply of new teachers and a large exodus of veteran teachers should not be to lower standards to attract more prospective teachers; the academic achievement levels of entering teachers are already among the lowest of the college graduates. Nor will it be prudent to attract individuals to the profession with subject matter expertise but little knowledge or training in the teaching of that subject. Knowledge of the subject matter does not necessarily make a successful teacher. Rather, institutions across the country must recognize and utilize a new source of highly qualified teachers who possess extensive subject matter knowledge and understanding as well as ample and directed training in techniques to transmit this knowledge to students.

AN INNOVATIVE SOLUTION: THE MID CAREER MATH AND SCIENCE PROGRAM

To address the increasingly critical shortage of high-quality math and science teachers, the Harvard Graduate School of Education (HGSE) crafted an unusual response. The Mid Career Math and Science Program is designed to provide mid to late-career professionals who already possess quantitative backgrounds in high technology, scientific research, and financial services with the training they need to become secondary math and science classroom teachers.

Early experience with the Mid Career Math and Science Program at the Harvard Graduate School of Education suggests that individuals possessing these important skills and the willingness to enter the teaching profession do exist. Now in its fourth year of operation, the Mid Career Math and Science Program demonstrates that this new source of quantitatively trained individuals represents an alternative supply of classroom teachers. The program, which awards either a Master's Degree or a Certificate of Advanced Study, is conducted during the academic year with optional summer study workshops. Some individuals choose to pursue the program half-time while changing from their former careers. All participants intend to undertake full-time classroom teaching assignments upon completion of the program.

Most important, the program is accredited by the Massachusetts Department of Education. Graduates receive teaching credentials for middle or high school teaching positions of mathematics, physics, chemistry, biology or general science. This certificate is transferable to over 25 other states through reciprocity agreements.

The MCMS Program has four objectives:

1. To improve the condition of math and science education for children at the precollegiate level by crafting an innovative response to the shortage of qualified teachers
2. To demonstrate that a previously under-utilized and large labor pool for education--mid/late career professionals--can and will make a significant contribution to the education of our nation's youth
3. To infuse school setting and curricula with knowledge conveyed by mid/late career professionals of realistic applications of math and science
4. To offer an innovative model for other educational institutions across the country to address the condition of secondary mathematics and science education at the local level.

PARTICIPANTS

The quality of individuals the MCMS Program attracts is impressive and surprising to some. The men and women participating in the program's first three years have had diverse backgrounds and careers, including a retired rear admiral and army colonel, electrical, civil, chemical and mechanical engineers, biochemistry and microbiology specialists, physicists, photographic scientists, higher education professors of chemistry and physics, a public defender with an undergraduate degree in mathematics, a missile system designer, a chief meteorologist from the U.S. Weather Service, statisticians, geologists and a veterinarian technician. Over 625 individuals have, since June 1984, expressed an interest in attending the program for the 1985-86 year. The vast majority of these individuals have Master's or Doctoral degrees in the fields they intend to teach.

Mid Career professionals are a particularly appropriate source of new teachers because many of the economic, social, and demographic factors mentioned previously are not as constraining for this group. Many potential participants in the 50 to 60 year old age bracket are eligible for early retirement or voluntary severance plans. Depending on the industry and the employee's status, good pension plans are also available to them, frequently guaranteeing up to 50% of previous income levels.

The social argument that teaching is not a status-conferring career also bears less influence on mid career professionals because many professionals have already established their reputations in another field. Recent research on career development indicates that many individuals in this age bracket have

economically--and psychologically--"plateaued" in the corporate world and would welcome an opportunity for new challenges (13). Teaching as a second or third career offers a change of pace and a new employment environment.

The demographic factors that will contribute to the trickle of young people entering teaching are also more favorable for the mid career professionals. The age group of 49-54 year olds will increase significantly in the next decade (14). This factor, coupled with the increasing interest and legality of professionals to work beyond the age of 62 or 65, combined with increased early retirements, make the potential contribution of this age group extremely large.

ACADEMIC QUALITY AND MOTIVATION

Concern about the academic quality of teachers has at its roots the fact that the vast majority of new U.S. teachers in any field rated in the bottom third of their class on measures of academic ability (15). Equally disturbing is the finding that the least academically able are likely to stay in the profession while those with more academic ability leave after a short period of service. While there has been some debate as to the relationship between teacher academic ability and student achievement, recent research now shows a modest relationship between the verbal ability of teachers and students' learning (16). These findings give a foundation to the clarion calls for high entrance standards for the profession.

Through an examination of student applications to the Mid Career Math and Science Program from 1983 to 1985, it is clear that the MCMS program attracts teacher trainees who do not reflect the academic profile of others intending to teach. Indeed, these candidates present extraordinarily strong academic credentials. On the Graduate Record Examination, applicants from 1983 to 1985 for the Mid Career Math and Science Program had a mean verbal score of 618 and a mean quantitative score of 634. Based on data provided by the Graduate Record Examination Board about test takers intending to enroll in education (including teacher training) programs, these results fall respectively in the 95th and 91st percentiles nationally. With respect to academic talent, teacher candidates in the Mid Career Math and Science Program represent individuals who, unlike their counterparts in other "traditional" programs, are academically outstanding. Their academic excellence may in part be explained by an observation of sociologist Dan Lortie: "Teaching is somewhat special in that those who enter it as a second choice possess above-average educational qualifications. In that sense, teaching has an enviable competitive position; its accessibility fosters the entrance of people who might never have gone to college to become teachers" (17).

The reasons these participants have given for wanting to become classroom teachers at mid career are varied, but two common themes emerge: (1) the desire to change the quality of their own lives and (2) the wish to contribute to the education of young people. Take, for instance, a Ph.D. chemical engineer who was among the program's first graduates. This individual stated,

I've acquired all this knowledge [while obtaining a Ph.D.] and I'm looking for an opportunity to pass it along. It's not that I don't feel good about engineering! But I think I'd feel better if I had a chance to influence some students. I want to do something more meaningful with my life.

Professionals also express a desire to empower younger individuals with knowledge. References to the "next generation" are frequent. Another candidate, presenting his motives for a shift to teaching, wrote,

I do this because in the last analysis, I have learned something about myself: that the pursuit of money and power has never been my goal; and that self-respect and the certain knowledge that I can contribute something worthwhile to society during my short stay here on earth are my primary concerns.

Other candidates express a concern about "quality of life" factors. Some note that business travel, competition, and the nature of the work with computers or other inanimate objects is no longer fulfilling. Although frequently expressed in interviews, one candidate wrote, "The involvement with people is an important factor to me because a good portion of my time in the past few years has been occupied in dealing with objects: engineering drawings and specifications, investigations, and reports." No candidates suggest that teaching is an easy job; their respect for the profession is immense. But they do perceive that the quality of life and opportunities for personal satisfaction will be much greater in teaching than in their previous careers.

THE PROGRAM OF STUDY

The nine months of study provided by the MCMS program include a total of eight courses divided among educational theory, methods of teaching math and science, classroom practice, and electives. Building on the in-depth subject matter expertise and familiarity with the real-world applications that participants already possess, the MCMS program provides the skills and credentials these individuals need to teach as well as a more realistic perspective on the educational process. More specifically, the academic program includes the study of teaching and learning from a developmental and cognitive psychological perspective, the study of schools as organizations, and the study of the practice of teaching in specific subject areas.

The program's participants also take a number of elective courses at the Graduate School of Education and other schools of Harvard University. These courses range from Adolescent Psychology to the Philosophy of Science. In addition, nearly all of the program's students participate in an examination of the psychological, pedagogical, and social impact of interactive technologies and computers on thinking and learning in the classroom.

Beyond their work at Harvard, participants work directly with practicing classroom teachers in a variety of school settings. The program strongly emphasizes this field-based component and encourages the active participation of classroom teachers in the training of these new teachers. The ratio of Harvard Graduate School of Education personnel who supervise the practice teaching component of the program to students is high, and mentor teachers within participating school districts receive special training to enhance their contact with program participants.

Although the annual enrollment of 20 students is a small number in the face of the critical shortages described above, the impact of programs such as the MCMS program should not be underestimated. Conservatively calculated, the 45 individuals graduating in the MCMS program's first 3 years each will teach 100 students per year; thus, after 5 years, these individuals will have directly affected the education of 16,000 secondary school students who might otherwise have been taught with less commitment, less enthusiasm, and less awareness of how math and science directly impact the quality of life.

FOOTNOTES

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4. Education Week, August, 1984; USA Today, February, 1983; Christian Science Monitor, July, 1982.
5. Massachusetts Department of Education, 1985.
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8. Levine, American School Board Journal, September, 1982.
9. Useem, "Education in a High Technology World; the Case of Route 128," 1982.
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14. Bureau of Census, 1982.
15. Weaver, "Solving the Problems of Teacher Quality, Part I," 1984.
16. Schlecthy and Vance, "The Distribution of Academic Ability in the Teaching Force," 1982.
17. Lortie, School Teacher, 1975, p. 49.

PARTNERSHIP ACTION IN PRINCE GEORGE'S COUNTY

Introduction of Dr. John A. Murphy

BROWN: In light of the fact that our subjects are different and yet closely related, we do want to take advantage of having an opportunity to interact with the various speakers. We are not going to entertain the Q&A's right now. Rather, we're going to let Dr. Murphy make his presentation and then we will have the three speakers at the table for the panel discussion. I want to thank Mr. Traver very much for a very interesting presentation.

I would like to present Dr. John Murphy, Superintendent of one of America's premier public school systems. Dr. Murphy's early education was in the North Adams Public School system of Massachusetts. He taught at the Greenfield Senior High School after getting his credentials at the Adams State College. After earning a Master's Degree from the University of Massachusetts, Dr. Murphy accepted a position as Associate Registrar at the College of Holy Cross. He is now Superintendent of Prince George's County Public Schools. I would like to thank Dr. Murphy for the way in which his leadership and support have helped NASA with respect to the Teacher In Space Program. David Zahren, who is one of our Teacher In Space Ambassadors, comes from Prince George's County. Pamela Bacon, who is on contract to my staff and has been invaluable in carrying out administrative support for the Teacher In Space Program, is also a teacher from Prince George's County. Through the graciousness of Dr. Murphy, we've had the advantage of utilizing these two people.

PARTNERSHIP ACTION IN PRINCE GEORGE'S COUNTY

Dr. John A. Murphy
Superintendent
Prince George's County Public Schools



MURPHY: My role this afternoon is to outline a case study in school-industry partnership using the Prince George's County Schools and community as a model. Before doing that, let me first acquaint you with Prince George's County.

The major long-range mission of our school system is to move academically from the 50th percentile to the top quartile by the year 1990. That, we believe, will be a very significant movement given the fact that our school system is a majority-minority system--60% of our students are black. While the critics of public education prophesied doom for urban education and quietly imply that schools can give up on the impoverished, we in Prince George's County intend to signal a resounding message that public education does work and works well for all Americans. Attaining our goal requires a rigid discipline and a planned attack. As we formulated our strategies and launched our assault, we looked to our business and industry council as a key member of our management team.

I came to Prince George's County in July 1984. Earlier that year, the former superintendent met with a group of business and industry leaders and suggested that a high-level advisory board be established to assist the school system as it looked to the future. When I arrived, I met with former county executive Winnie Kelly, the Chairman of the group, to discuss our perceptions of the role of such a committee.

Today, I want to share with you the strategies that have been developed and highlight some of our successful programs.

The strategies that we developed were surprisingly similar to those recommended a year later by the Committee for Economic Development in their study entitled "Investing In Our Children."

First, we felt a need to support the existing system and rebuild confidence and pride in our schools.

Second, we planned to begin the process of incremental change that would move our schools ahead.

And third, once that foundation was laid, we would move toward major structural changes that would make our system responsive to the changed society that education serves.

Supporting the existing school system is an appropriate strategy for helping basically sound school systems maintain quality, but it will not be sufficient to turn a poor or even fair system around. Participating in career awareness week, sponsoring scholarships for students and teachers, or donating a computer to the math lab provide important benefits to students and teachers but also imply acceptance of the existing goals and structure of the school and are not the kind of action that leads to change and basic reform.

During the past three years, a number of national studies have sounded an alarm and have proposed reform movements to correct the deficiencies in public education. The reform movement, while properly motivated, runs the risk of failure because the reforms for the most part are single-issue reforms. One report deals with teachers, another with high school standards, still another with science/math education. This cycle of criticism and recommendation is not new in education.

The danger is that the many good proposals that have been made will be lost as soon as media attention dissipates, which it will, once the reform fails to bring the desired results. Then we will be right back where we started--the same old public school system with the same old problems.

To understand why various attempts at change in education have failed, we must use the systems-theory approach. The most basic concept of this approach is that no one element exists in a vacuum, but that it always relates to other components of the system. Thus, if one element is altered, the relationships between it and the other factors are potentially affected. This modification places a stress on the entire system. If all the interrelated components can be made consistent with the reformed element, the change is accepted, the system restabilizes, and a type of synergy of effective, directed smooth functioning of the system results. If, however, reform in one element of the system is inconsistent with all the other components of the system, the change is rejected. The system strives to regulate itself to re-establish a steady state following the disruption.

Significant educational improvement of schooling, not mere tinkering, requires that we focus on entire schools, not just teachers or principals or curricula or organization or school-community relations, but all of these and more.

As we focus on change, we want to do so in an environment that will be supportive. Step one must be to build pride in the institution of public schools. Here in Prince George's County, our business and industry council used its unique talents to assist in this process. Firmly believing in step one, the council leadership undertook the task of re-establishing pride as its first major goal. As a

preliminary step, it supported career days in our schools, not only to acquaint our students with careers, but to get our business and industry leaders into our schools to disclaim the rampant rumors that public education was in chaos. Our schools were suffering from a very negative image, not totally deserved.

While we have problems, many youngsters are receiving a very good education, and our council wanted to point this out to our leaders. Once we got the leaders into our schools, we were able to discuss the needs of education from a more realistic perspective.

With this new knowledge base, our committees could then launch phase 2 of the plan. With the leadership of Charlie Dukes, a local banker, and Winnie Kelly, a public relations firm was enlisted to help in addressing the image problem. A series of ads were piloted to focus on the successes of the Prince George's Schools.

The money to develop these ads (\$60,000) was contributed by a few believers. We still needed \$200,000 to get the ads on prime time television. Mr. Dukes and Mr. Kelly then had two major breakfasts for business and industry leaders to discuss the problem. The money was raised!

This support of the existing system continues as we take the next step--incremental change.

Our vision of excellence presupposes accepting the notion that our present school system may not be able to fulfill this new mission. This does not, of course, mean scrapping the present system of schooling. It still serves well the needs of many. Given the diversity and pluralism in the United States, it is unrealistic and unnecessary to expect an across-the-board thrust for a newer model of public education. The aim must be the conversion from the old to the new. In the process, those who want to remain with the present model of schooling should have the right to do so. Those who seek options to the present structure should have the same right. Unlike the old standardized and uniform public school system, the newer version includes options and choice; it is not simply imposing one orthodoxy in place of another.

In an effort to deal creatively with the need to resolve a long-standing desegregation battle and to begin the systematic restructuring of our offerings, we embarked on a system of choices. A variety of new schools were opened with specialized program offerings and new instructional methodology. Added to our two existing science tech high schools were three math-science middle schools and three math-science elementary schools. We opened tag schools for the gifted and talented, Montessori schools for age 3 and up, foreign language immersion schools for grades K-6, extended day schools, traditional academies, a high school specializing in humanities, and next year will add performing arts K-12 as well as a very creative university high school, planned in cooperation with the University of Maryland.

Our Business and Industry Council has been instrumental in support of these changes as well as in enlisting special business and industry partners to establish working relationships in these schools. These businesses have offered their assistance in donating not only their staff time, but also in working with us to

develop the curriculum. Goddard, for example, has worked closely with us in developing our science and math concept programs. This type of assistance is critical to our effort to provide quality education.

If we want to improve our image, it is crucial to retain and attract quality teachers in our classrooms. The next few years will see extremely difficult conditions for filling teaching vacancies in our public schools. This is the result of past Reduction In Force (RIF) practices and the new baby boomlet.

Prince George's County needs to fill approximately 400 new positions each year, and the history of the past 5 years caused alarm as we began planning for the future.

We took our problem to the advisory council. Ray Laplaca a prominent businessman was asked to chair a committee to address this problem, and he returned with a plan of action. That plan involved a drastic departure from the traditional school recruitment techniques. Ray and his committee outlined a new procedure that involved high visibility recruiting.

At the consortium meeting, applicants were offered apples for the teacher--balloons, free TV, public relations pitch for business leaders, and incentives that included one month's free rent, no security deposit, favored bank loans, VISA/Mastercard with no fee, low cost automobile loans, discount coupons at local restaurants, and more.

Ray and his team traveled with our team to aid them in recruiting and to give firsthand tips. The result was 7,000 requests, 4,000 applicants for 400 positions--in a time of great shortage. Going the next step in partnership with us, our advisory council also established a vocational and career education committee that is studying our total vocational delivery system. They will assist us in evaluating our existing system, work cooperatively with us as we design a performance-based system that will address the skills needed by our graduates, and then work to establish a community-based evaluation system that will assist with future quality control.

Vocational education is just a starting point. We expect this type of participation in all areas of our curriculum.

When Mr. Kelly and I first discussed the role of business and industry, we were in total agreement on one very basic starting point. We believe that business and industry should not become a significant funding source for public education. We don't want to "nickle and dime" our business and industrial leaders. Education should be supported by the taxpayers, and business and industry pay their fair share of taxes. What we want is your talent, your counsel, your creativity, your advice, your power!! Educational, political, and economic conditions appear to be ripe for an investment in a redesigned system of education. Fortunately, we need not scrap the old while we build the new. The old still needs to carry most of the burden despite its shortcomings. This is why school improvement is a necessary stage in the multi-phased process of modernization. School improvement is not an end but a means to the ultimate restructuring and remodeling of education. If school improvement becomes an end rather than a means, a once-in-a-century opportunity for designing a new human learning paradigm will be missed.

Leadership is essential for this synthesis. The involvement of business and industry with school reform make you not only knowledgeable parties about, but also powerful processors of, model reform. When you speak, political officials listen. Professional and civic associations and officials from higher education are also influential participants. These voices need to be coordinated on behalf of sound educational reform. Thank you.

PANEL

Moderator:

Dr. Robert W. Brown
Director, Educational
Affairs Division
NASA Headquarters



QUESTION: How much does it cost to go through the Mid Career Math and Science Program to earn the Harvard Master's degree and receive Massachusetts State Certification?

TRAYER: It is a 1 year program and when tuition, room, and board, and everything else is taken into consideration, it is about \$15,000. However, as a University, we get financial aid from the Federal Government through various loan programs that are made available to universities. Another Federal Government program is work-study. Work-study supplies part of the wages that are paid to students for work; several of our students participate. The third way we receive financial aid is through corporate and business sponsorship. Some of these scholarships are "named scholarships." They are called "such and such a company scholarship" and are awarded to a student. Harvard, like many universities, makes a point of making it possible for a student who has been admitted to work things out financially. There are a lot of conditions surrounding the figure of \$15,000 mentioned earlier.

QUESTION: It has been rumored that Harvard is requiring psychological testing to determine how many of its applicants have the potential to teach well. Can you tell us about that?

TRAYER: If in fact Harvard is seen as selective, then our program is an exception during a time when so many programs are characterized as "easy access." In fact, the average Graduate Record Examination (GRE) score of our entering students is about 1300. Compare that to the 900 score of a typical education major. We are also selective in the sense that not all people who apply to the program are admitted. But we also work very hard in our recruiting. We recruit for people whom we have heard are interested in high school teaching and already show that they have the background knowledge and the interests to do at least a competent job. But we are certainly not elitist. Other than GRE or Miller's Analogy Test, we do not conduct any psychological tests for admission purposes.

QUESTION: What kinds of admission requirements are set by the Mid Career Math and Science Program? Also, can the program be completed on a part-time basis?

TRAVER: Admission is based on a number of factors. First, we ask, "Does this person have a background in math and science that can meet the Massachusetts State Certification requirements?" Usually, this requirement is met by an undergraduate degree or a Master's Degree in a science or math field. Persons without this strong subject matter preparation will not find our program geared for them. Sometimes, though, a person is one or two courses short, and that can be remediated with electives. Second, we look at whether or not a person really wants to teach. If people say, "Look, I really want to teach school; I really want to help kids; I think this is something I can do," then that's a very strong point in their favor and the Admissions Committee will respond to it positively. Of course, it is required that the student afford the time to complete the program. In response to the second part of your question, some of our students are part-time. They stay with their jobs and take their courses, and it takes them two semesters to do one semester's work.

QUESTION: Do business and research people really learn to deal with differences in income that take place when they switch to teaching?

TRAVER: Yes. It's different for each person in many ways. Some students are coming from positions that are not radically different in regards to income. Some are coming from positions that are very different and they are, for one or more reasons, willing to take that salary decrease. Many of our older applicants are beyond the large financial drains. For instance, their children have gone through college or the house is paid for. Since these big factors are out of the way, a change of \$15,000, \$20,000, in some cases, \$30,000 is not a major concern. Another reason is that there is a powerful drive that has sent many of us into school teaching against all the predictions of economists. We simply don't put high value on the finances. We are willing to forego many material opportunities for the other sorts of rewards that we see in teaching. The person who simply cannot do it financially, or doesn't wish to do it financially, would just not join the program.

QUESTION: With all this talk about finances and salaries, it seems that merit pay plans have a lot to offer.

TRAVER: Yes and no. Merit pay has to be considered in light of why teachers enter and leave teaching, and the nature of the work itself. I don't think merit salaries alone are the answer. In fact, a lot of evidence demonstrates that pay scales based on performance don't work because teacher effectiveness is extremely difficult to measure. On the other hand, giving all teachers more money has limited value, too. A poor teacher is a poor teacher, and if you pay him more, it's not going to make him better. One thing that we have to do is begin changing working conditions in our profession to attract more people. A secondary teacher, for example, gets more freedom than an elementary teacher who goes all day long, sometimes without even a lunch break. They don't even get a chance to have a lunch by themselves--they are with youngsters all day. We have to examine all the factors that go into making teaching both a desirable and undesirable career--and then emphasize the positive and delete the negative. Attracting and keeping good teachers is a complicated but not unsolvable problem.

QUESTION: Were you just saying that merit pay and improved finances aren't important?

TRAYER: What I was trying to say is: all the reasons for the existence of a qualified teacher crisis are not summed up in the word "money." There is another important package of reasons called working conditions. There are also a whole series of other things that school teachers identify as reasons for leaving teaching. Some of them even say that they don't like youngsters any more. Put another way, I am saying, and other people have said, that if working conditions were much more in a way that a teacher could enjoy, then the money reason would become less a factor because people would enjoy what they are doing. School teachers, particularly ones who have indicated that they would like to stay, would be willing to go with smaller salary. What is happening now is that when you say to a school teacher who doesn't enjoy the work anymore, "Well, why do you want to leave?," they say, "because the money isn't there." And what they are asking for is more money to pay for the fact that they're suffering on that job. But if we removed the extremely difficult working conditions, and made them more acceptable, many good teachers would continue to work. And, of course, there are certainly teachers leaving school who are doing so simply because they can make more money. There is no question about that. What I'm trying to do is to extend the number of explanations as to why teachers are leaving school. It's more than an all-or-nothing kind of thing.

THE BELLOWS EFFECT

Introduction of Dr. Antionette Favazza-Wiegand

BAILEY: Dr. Antionette Favazza-Wiegand is currently the State Director of the Maryland Summer Centers for the Gifted and Talented Students. Dr. Favazza has a Bachelor's Degree in English from the University of Miami, a Master's in reading from Glasboro State College, and a Doctorate from Johns Hopkins University in human communications and its disorders. She has been a trainer of residential and quality assurance nurses, at Johns Hopkins and at New York University. She's also been National Program Coordinator for the Center for Talented Youth at Johns Hopkins. She has taught in private school, public schools, and parochial schools. She has taught special education students, gifted and talented students, and average students.

THE BELLOWS EFFECT

Dr. Antoinette Favazza-Wiegand
State Director
Maryland Summer Centers
for the Gifted and Talented



FAVAZZA-WIEGAND: Thank you very much. Good afternoon. On behalf of Dr. David Hornbeck, Maryland State Superintendent of Schools and the State Department of Education, I'd like to profile the summer centers program. It is my privilege to direct this program along with 250 outstanding faculty and staff members who are exemplary role models for 2600 gifted and talented students whom we serve. National recognition as well as statewide recognition of this program is received because it addresses both cognitive and affective development of the student, and because it allows the students to apply their knowledge to real-world practical situations.

I'd like to refer to something that Dr. Brown and Dr. Murphy mentioned to you earlier today, that is, the concerns about future work force, productivity, and the relevance of education for the 21st century. In 1982, the Education Commission of the States issued a report outlining certain basics of tomorrow which students will need to become contributing citizens of the 21st century.

Creative problem solving, critical thinking skills, and decision-making processes, are things you would want to have employees able to execute on a daily basis. No matter what field, whether they are scientists, engineers, or employees of a specific industrial corporation, you want to have people who can communicate effectively, who can solve problems, and who look for the short-term consequences and long-range implications of their decisions. It is vital that we prepare students to be able to apply higher order thinking skills in practical situations. This same report indicated that in 1982 there was a very small percentage of students who were graduating at 17 years old that were capable of exercising higher order thinking skills and using them regularly. The good news is that there is an educational program in Maryland which certainly fosters critical thinking, creative problem solving and decision making, and also meets the criteria defined in Public Law 94.142, which defined areas for gifted and talented education: general intellectual ability, academic aptitude in a specific discipline,

creativity, leadership, and the visual and performing arts. If you're in education, you know about these five areas. If you're in business, perhaps you might be familiar with the area of general intellectual ability or specific academic talent because you're looking for those mathematicians and scientists as employees. Leadership is an area to be addressed as defined in the law; however, it is difficult to find a program which meets the specific needs of leadership development. Our state program is unique because it includes programs which address all five areas of Public Law 94.142. It is also important to note that there is no state mandate in Maryland for gifted education. In this state, I suppose there is a good and bad side to not having a mandate. The good side is that we have been receiving funding for the summer institutes on a statewide level since 1967. We were also receiving federal funds, but as you know federal funds were more accessible in the early 1960s. We started with the Arts Center in 1967 and have grown to 13 centers in 1986. The downside of state funding levels, however, is that every year we have to go back to the state legislature to renew our funding. In that respect, the Maryland Summer Centers differs from other "Governor's School" type programs. In Governor's Schools, the funding is appropriated directly from the Governor's budget. Fortunately, for the past several years we have received the funding required to serve 2,600 students. Unfortunately, we turned away about 2,500 other students because we don't have space for them.

I'm going to show you a video that highlights leadership development and creativity as well as the other areas defined in Public Law 94.142 for the gifted and talented. The course offerings in these two areas distinguish this state-sponsored summer program when compared to other programs that might operate as Governor's Schools. Our program will serve a broader purpose, if business becomes more involved. We have two fine examples of collaborative efforts among our educational institutions, institutes of higher education, and business and industry: the Center for Internships and the Center for Space Science Studies. The internship program operates throughout the Washington-Baltimore area in cooperation with the University of Maryland and local businesses and government agencies. The Center for Space Science Studies operates at NASA Goddard Space Flight Center for secondary school students who intern with scientists and engineers in specific areas of study. But we need more business involvement in the areas of technology and computer operations. We have students who would like to have internships, for example, in business offices where computers are used on a daily basis for projections or for fiscal planning, but they don't have access to those opportunities.

We can't offer in a two or four week period experiences that will get students into a real-life situation of business and industry. We can only simulate these experiences. So I ask you to keep in mind, as we continue, what you might be willing to offer in the form of internships.

You may be wondering how we select our student interns. First, the students submit an application through the self-nomination process. The Maryland Summer Centers for Gifted and Talented Students brochure is distributed to all public, private, and parochial schools in Maryland in January. On the center page is an application which students must fill out themselves. Next, a teacher nomination must be obtained, and a student essay must be submitted. Finally, achievement and aptitude test scores are completed by the principal or counselor. The application process is comprehensive. All students in the school system in Maryland, are eligible to attend this program. They need not be in a gifted and talented program in their local system in order to apply. This

comprehensive application process is another way in which our program differs from a Governor's School. For example, in Pennsylvania or Texas, students must be in a gifted and talented program in their local school systems in order to be considered for nomination by the school district. Another program characteristic we should not overlook is the long history of inter-institutional collaboration efforts in this statewide program. NASA was one of the first collaborators; Elva Bailey and Jim Latham, now Director of the Division of Instruction at the State Department of Education, decided it would be a good idea to have students to work directly with scientists and engineers in advanced laboratories and on actual projects. This is the eighth year that we've had a fully developed program for junior and senior high schools operating at NASA Goddard Space Flight Center. There are other agencies and institutions involved with this program. The Maryland Science Center is operated for elementary and middle school students. We worked with the National Aquarium in Baltimore to develop a program for fourth, fifth, and sixth graders at that site. In addition, we offer leadership development courses for senior high students through the Maryland Leadership Workshop. This year, we initiated a Center for Archaeological Research in cooperation with the Maryland Historical Trust in Annapolis. We must develop manpower resources to augment our limited funding to produce the best preparation for gifted and talented students in order to increase the work force productivity in this country.

The other component that I think is worth mentioning is the evaluation process for the program. Since we're a state program, we operate a statewide evaluation process. On-site evaluation teams comprised of professionals from all across the state--practicing professionals and teachers not associated with the Maryland State Department of Education--observe our centers. There are also people like myself--other State Department of Education specialists--who visit and evaluate centers. Students complete an evaluation questionnaire. The faculty completes a separate evaluation questionnaire, as do all the center directors. Finally, center directors and host institutions submit evaluative reports. So there is a full process of evaluation. Based on the feedback from the evaluation data, we modify our programs for the following year. I think it's also worth mentioning that while this short-term, 1 year cycle of evaluation is good, what we really need is a long-term research and evaluation, i.e., a study which measures the impact of this program on students 5 or 10 years later. Are these participants more likely to enter careers in the sciences? Are they likely to study more advanced-level mathematics? We don't know. We obviously have access to student data, but we need computer programming services, as well as the keypunching services which are necessary to follow through on such a project. We have ideas for formulating a longitudinal student survey instrument that can be used to document the long-term value of the program and the appropriate intervention it provides for the student.

The program is deliberately student centered as opposed to teacher directed. One of the guiding principles of this program is to focus on the individual child as a whole. Sometimes when you work with gifted students, you tend to focus on the academic side. You realize this person has potential, and you want to develop it as quickly and fully as possible. In our zealotness, however, we forget that there's another side of that person. It is vital to nurture development in the affective domain and give it equal importance with academic

development. Counseling, group dynamics, group process, and group decision making are integral components of the program. Equally as important as applied intellectual talents are effective communication and group process skills in a business situation. You have to know how to work with other people.

In reshaping this educational model for the regular school program, the Maryland Summer Centers program can serve as the change agent for program improvement. In essence, these 13 centers function much like R & D labs for education. Each of these centers focuses on a different content area and often pilots an innovative instructional delivery system. The development of programs which utilize the finest teachers and professional experts in unique learning environments with highly motivated, bright children often results in the emergence of innovative types of methodology and instructional strategies. This is an important point because we are not just using funds to affect a small number of students, but rather are creating models of educational excellence which extend beyond the summer experience and potentially can affect the methodology and instructional delivery systems in academic-year programs. Thus, the impact of initial dollar-investment for these R&D centers potentially can be multiplied when these programs are replicated in a local school system or in a setting in another state.

In a yearly cycle, we identify the students, hire the staff, develop curriculum, implement staff development plans, operate the programs for two-week, four-week, or six-week sessions in both residential and non-residential settings for entering fourth through twelfth graders, and finally, we evaluate programs. Based on the evaluation process, we make appropriate modifications to course offerings, determine what new centers we might like to open or consolidate, and decide what new instructional delivery systems might be developed. The Maryland Summer Centers model is unique in regard to this yearly cycle. In several other states where state-sponsored or Governor's School programs exist, proposals from different colleges, universities, institutions, or local districts are solicited and reviewed, and grants are awarded on a year-to-year basis. Therefore, the sites and course offerings may vary greatly from year to year. Naturally, this impairs development of a continuous scope and sequence in consistent content area offerings. Since we exercise deliberate control of the development of curricular offerings, we know that the students are being taught and can respond to current educational needs. The objective of the program is to offer cutting-edge coursework which includes advanced technology and application of theoretical concepts to practical settings with experts. This objective, coupled with a focus on creative problem solving, critical thinking, and decision-making processes, will establish a long-term record for quality programs for gifted students in the state of Maryland.

H.R. 3263 was recently passed by the House of Representatives. It would establish a national commission for gifted and talented students and promote a center for research and development of gifted programs. About 70% of the funds would go to states. More important than the dollar amount, this type of legislation would make a statement that there is a need for gifted and talented education. Since there's no mandate in many states, funding commitments are made on an individual basis from year to year. In Maryland, the individual local jurisdiction determines how much money it wants to allocate for gifted programs. Again, the Maryland Summer Centers has been fortunate to receive continued support and funding from the state legislature. Corporations may want to consider writing in support of this type of legislation.

Finally, I wish to share an anecdote about a Maryland family. The father is here today. Perhaps he'll elaborate on the story of a French student who spent last summer with them. The boy was amazed that the Americans were paying for the college education of their son. In France, he told them, a national exam determines who can go to college; and then attendance is free. The American student said that nothing is really free and he asked where the money came from. The answer was from a 30% tax on luxuries. The French boy said, "For example, a car is a luxury and we pay \$13,000 for a \$10,000 car." When the American asked why they would tax themselves so heavily the French student very proudly said that no matter how poor any family may be its talented children will be developed. "We use the bellows," he said, pumping his arms, "to make a spark into a flame."

Shouldn't we Americans, start to nurture the naturally gifted and talented students in our country?

THE BELLOWS EFFECT Presider's Comment

BOYLE: Thank you, Dr. Favazza. And thanks for the anecdote. It emphasized the title of your inspiring talk. The French student was actually the guest of my son, Neil. I asked some questions, too, about France's reason for funding education so heavily. I was told that France is a relatively small country, but must compete against the super powers. He said, "You may be big enough to neglect people. We can't afford to waste any talent. We have to find and use all we may have." And he repeated that a country has an obligation to put the bellows on its bright young people. He did not understand our behavior. It seems to me, Toni, that he'd applaud what you are doing in your summer programs for the gifted and talented. Now for some questions.

QUESTION: Do you do anything to integrate the students back into a normal classroom for the rest of the year?

FAVAZZA-WIEGAND: The main thing that we do is try to support the networks that are formed informally during the summer and encourage social gatherings and a communication network during the year. Academically, we do encourage the students to go back with the brochure and explain what it is that they have done so that they can take advantage of new experiences which may be available to them in the regular program. This program is not an accelerative program by nature; it is an enriching and student centered program. The main focus is on the processes of learning. We encourage the students to reapply the learned skills and processes in their regular school setting.

PARTICIPANTS-CONTRIBUTIONS BRIEFING

Introduction of Dr. Kermit L. Smith

BOYLE: Part of our charge is to transfer these ideas into actions. The coordinator of that effort is Kermit Smith. He's a senior scientist with Palo Alto Research Labs, Lockheed, and as a solar physicist has been associated with numerous rockets, satellites, and space shuttle projects. Kermit is currently working on the Solar Maximum Satellite project. In 1972, he originated a science-work experience program which has since graduated over 200 high school students. He will describe the process we will use to develop tangible results.

PARTICIPANTS-CONTRIBUTIONS BRIEFING

Dr. Kermit L. Smith
Senior Scientist
The Solar Max Mission
NASA Goddard Space Flight Center
Lockheed Palo Alto Research Laboratories



SMITH: Dr. John Murphy of the Prince George's County School District told you about a brochure, Investing in Our Children: Business and the Public Schools, from the Committee for Economic Development. I have also provided their press release to this group. It's appropriate to review this three-year, million dollar research project that tells of programs, projects, and things that need to be done to further education. We have to create partnerships between education and industry.

We will plan two separate wrap-up sessions; your ideas and concepts will be reported back to the entire audience so that we can all have their benefit. Tomorrow we will focus on issues, future programs, and prospects. A forum recorder will be at each of the sessions to record the best ideas for future educational partnerships with industry. The forum moderators will each present to the entire conference a ten minute overview of the recommendations from each forum, which will become part of the published proceedings of this Conference. We hope that industry and education, with perhaps the commendable assistance of NASA, can carry out these future partnerships in education.

RCA AND THE SOUTH JERSEY EXPERIENCE

Introduction of Mr. Tom Chavis

BOYLE: Tom Chavis is currently an educational consultant to RCA. Mr. Chavis is a graduate of San Diego State College and has a graduate degree in International Relations from the National War College. He served in the U.S. Army from 1940 to 1969, rising to the rank of colonel. In 1965, he commanded the Army's Research Office in Washington. His last assignment in the Army was Director of Missiles and Space. He joined RCA in 1969 as manager of Program Support/Advanced Programs Development for RCA Government Systems.

In 1978, Mr. Chavis started the Orbit '81 educational project and upon his retirement, in 1981, was appointed project consultant. He is an author and a holder of several patents. He is active in civic and community affairs in Medford, New Jersey, and is on the Board of the Burlington County Chapter of the American Red Cross. We are fortunate to be able to have a description of Orbit '81 and its effect on the Camden, New Jersey school system.

RCA AND THE SOUTH JERSEY EXPERIENCE

Mr. Thomas N. Chavis
RCA Retiree and Consultant



CHAVIS: I first want to thank Elva Bailey, Dr. Brown, and Dick Crone for the outstanding support that NASA has given to the Camden High Schools Program.

Our program is divided into two parts. I will explain Orbit '81 and several of the courses of action we took to maintain momentum, to keep the students and teachers interested. Jim Palmer, Chairman of the South Jersey Chamber Foundation, will then give some recent examples of academia/business partnerships which resulted in part from Orbit '81. (What follows is the audio portion of a videotape of Walter Cronkite's Universe Program on August 14, 1982, on CBS Television.)

THE SPACE SHUTTLE- IMAGINE COMMUTING TO WORK IN THAT ROCKETSHIP

"We will be talking to a young woman tonight who expects to do just that. That story and others tonight as we explore our universe. There is a crisis in American science education. Over the past decade, there has been an alarming decline in the number of college freshmen who have decided to major in science and mathematics. Enrollment in math in our colleges has decreased 72% between 1975 and 1980. Our standards for training children has fallen behind countries like Japan, Germany, and the Soviet Union. Among 14 year-olds in 19 countries, Japanese students ranked first in overall science. U.S. medical students ranked 15 out of 19 countries. Only half of U.S. students take even one year of plane geometry. Soviet students take over ten years of math. Who will pay the price for this lack of emphasis in our schools on science and math? Japan is now graduating five times as many engineers as the United States."

"There is one shining example in this country of attempts to improve our science education. It is happening in Camden, New Jersey. Camden, New Jersey, is just across the river from Philadelphia. It was once an industrial giant but now seems more like a bombed-out city. Outside on the streets of Camden, poverty is evident everywhere. But inside Camden High School on this midday afternoon there are hopes and dreams which reach all the way to outer space."

"NASA Astronaut, Guion Bluford, has come to the assembly of Camden High in honor of Bluford's science feats. With slides and skits, students summed up their work to date on an experiment they are preparing for a flight aboard the Space Shuttle. But this isn't just a celebration of the school's science project; this is a triumph of a four year program that teamed up inner-city minority youngsters, engineers, and scientists of a big corporation, RCA, on a project never before undertaken even by NASA. A social group of animals have never been sent up in space. How weightlessness affects a large group as a whole, is what we are trying to find out."

CHAVIS: On June 18, 1983, after 5 years of planning, working, and waiting, students from two southern New Jersey high schools watched the Challenger roar into space from the Kennedy Space Center. On board was not only the first female U.S. astronaut, but also the first colony of pioneers--150 carpenter ants. The experiment, called Orbit '81, was born when Dr. Irving K. Kessler, an Executive Vice President (RCA) offered to sponsor a NASA "Get-Away Special" experiment for Camden and Woodrow Wilson High Schools. It was understood that this would be a cooperative effort among educators, business leaders, and the community to revitalize student interest in science and math, to increase student pride, to show how an inner-city school can demonstrate academic excellence through teamwork (the primary goal of the national educational reform movement), and provide hands-on experience to students in nontraditional areas of engineering, project management, publishing, and public relations. This 5-year partnership linking industry and education was founded upon, and successful because of, leadership, public support, and, most important, quality teaching.

Leadership

A bargain was struck in 1977 at a dinner meeting of South Jersey community leaders; if Camden High School principal Riletta Cream would commit Camden and Woodrow Wilson High School students to undertake a significant science experiment, RCA's Kessler would pledge RCA to provide technical, material, and financial assistance for the program. RCA officials and school staff members exemplified cross organizational team management/leadership when they mapped out several conditions for the program, including implementation of 3 years of enriched science instruction for each participating core student, utilization of the teamwork approach to the program resembling the problem-solving methodology used in industry, and specialized contributions to the program from as many segments of the school population as possible.

To fulfill the first of these prerequisites, faculty members and administration from both high schools developed a "space science" curricula which encompassed space environment studies of the "Get-Away Special" program. This curricula, of course, supplemented enriched programs in math and science. Mr. Palmer will give details of the curriculum. A 6-week summer enrichment program was conducted each year for 40 to 45 new core students entering the project.

Second, as engineers operate in industry, participating students were organized into work teams. A biology team studied the ants and determined conditions necessary to ensure their survival in space, while a computer team studied computer technology and developed flow charts and a program for the onboard microprocessor which would control the experiment's camera, lights, air conditioning, and other equipment. An engineering team designed and constructed the canister housing the experiment with the help of the vocational school.

To meet the third prerequisite of widespread student involvement an interdisciplinary team approach was used. Participation throughout both schools was broad and included the following disciplines and roles performed by the students:

Science/Math Students

- Formed a major part of the Orbit '81 core group
- Selected the experiment
- Developed concepts, conducted research and development, and prepared for launch
- Prepared reports
- Conducted in-process reviews
- Assisted in configuration management

Industrial Arts Students

- Assisted in graphic design
- Fabricated, manufactured and assembled the experiment
- Assisted in configuration management
- Built models and prototypes

English Students

- Assisted math/science students in the preparation of proposals for grants and contracts to support the program
- Prepared civic and professional presentations

Art Students

- Promoted Orbit '81 with posters
- Produced program-related murals for school halls and special assemblies

Library Science Students

- Maintained all daily, periodic, and professional files

Business Students:

- Managed all financial responsibilities, including field trips, training, equipment purchases

Journalism Students

- Published newsletter
- Prepared press releases with assistance from RCA
- Prepared advertising for all events
- Assisted English students in the preparation of proposals

Speech Students

- Prepared and conducted briefings

Geography Students

- Conducted research for preparation of curriculum on outer space
- Prepared curriculum "A Tour of the Planets" in use today

Drama Students

- Conducted a minimum of five Orbit '81 visitors assemblies each year
- Conducted skits to motivate students

Home Economics Students

- Prepared meals for all visitors and visiting instructor teams
- Prepared snacks for all trips

Band Students

- Participated in all major Orbit '81 events and assemblies
- Composed Orbit '81 theme song
- Promoted fund-raising activities

Athletic Teams

- Conducted an annual "old timer's tournament" to raise money
- Assisted in fund-raising and advertising events

Astronomy Students

- ° New curriculum added as a result of Orbit '81 program

At Camden High School, approximately 20 academically talented students were selected for the Orbit '81 core group, although more than 300 students directly participated in some facet of the program. Anyone who wanted to help became a part of the mission team. Thus, teamwork and cooperation among students, schools, businesses, and educational institutions became the hallmark of the Orbit '81 program.

Public Support

The public support program spelled success long before the Orbit '81 experiment left the launch pad on June 18, 1983. "Between the rough idea and the fully developed program came the contributions and talents of literally dozens of teachers, school administrators, [and] NASA and RCA personnel." RCA engineers, for example, worked patiently with students and teachers by giving presentations and laboratory training, which were used to solve many problems.

Public support was also demonstrated when the South Jersey Chamber Foundation (an affiliate of the South Jersey Chamber of Commerce) adopted a resolution which recognized administrators, teachers, and students, all of Camden and Woodrow Wilson High Schools, and RCA, as an outstanding model of cooperation between industry and education. The resolution also recognized the high esteem in which both schools are held for their outstanding accomplishments by the South Jersey business community. To add to this success, more than 100 area businesses contributed money, facilities, equipment, and services to the project. Thus, this program provides a model of the many ways private industry, education, and the space industry can become partners in progress.

The South Jersey Chamber Foundation contributed (1) a science center at each of the two high schools and a computer lab at Camden High School, (2) funds for travel of students to other cities to help get space science programs started, (3) a source of engineers in various disciplines to teach courses in the schools, (4) travel funds for students, teachers, and engineers to visit Cape Kennedy for checkout of the experiment and to view the launch of Orbit '81, (5) a mailing list of industries to help student bodies raise funds for critical equipment for the program, and (6) funds for curriculum development and publication.

In an era when many observers are citing the decline of public education and low levels of student achievement in the United States, interest in Orbit '81 has helped boost science class enrollment at the two inner-city high schools by 100%. Some 60% of the Orbit '81 graduates have gone on to pursue academic degrees in engineering, computer science, and related fields at such schools as the University of Pennsylvania, Rutgers State University, Swarthmore College, and the United States Naval Academy.

Students themselves readily admit that any technical failure of the experiment or lack of significant data yielded by the experiment cannot diminish their achievements as a team. They have matured; they have learned to work together, as do members of industry; and they have discovered opportunities which

will enable them to put their new-found knowledge to work. This, in essence, was the underlying objective of the bargain struck by Dr. Irving K. Kessler and Riletta Cream in 1977.

The impact of the Orbit '81 program was made clear by President Reagan when he said, "There's a lesson here for all of us who believe that individual effort and initiative count and that we can make America's educational system what it should be--the best in the world. [This project] illustrates some very important lessons in the area of education. It shows the part local community involvement plays in stimulating intellectual curiosity and educational excellence." (The Sunday Record, June 19, 1983, P. A9)

How Were We Organized to Lead This Effort?

The project consisted of several committees whose members represented the two high schools, the school system (Camden Board of Education), and the corporate sponsors. They are as follows:

- Steering Committee

Responsible for overall policy, planning, coordination, and control of the program. It also offered guidance for related activities.

- Coordinators

Corporate Sponsor--available 24 hours a day. Responsible for seeing that resources are provided and objectives are met. Holds a coordinators' meeting every 2 weeks and manages corporate activities related to the program.

- School Coordinators

Manage program at the school level. Liaison with supporting corporation's coordinator. Evaluate and implement curriculum, and plan and execute interschool activities. Serve on steering and technical advisory committees. They represent the City Superintendent of Schools and their respective principals.

- Technical Advisory Committee

Execute policies and programs developed by the Steering Committee. Provide engineering guidance and classroom instruction; conduct in-process engineering and design reviews; assist in developing plans, programs, schedules, field trips, and budgets. Consisted of scientists and engineers from all RCA technical divisions and labs, consultants (retired and active from other industries), university professors, and the school coordinators.

- Curriculum Committee

Identify curriculum needs. Develop curriculum to fulfill the needs. Identify classroom materials and resources needed to execute the program. This committee recommended many improvements to the school laboratories and managed the lab improvement program.

RCA AND THE SOUTH JERSEY EXPERIENCE

Introduction of Mr. James E. Palmer

BOYLE: Thank you, Tom. It is hard to take several years of a lifetime and compress it as well as you've done for us today. C.P. Snow once said that we are evolving into two cultures--the technical and the nontechnical--and that one does not understand the other. Now and then we find people such as you and Jim Palmer who can bridge that gap.

Jim Palmer is President of Telenex Corporation and has been the Director of other South Jersey corporations. He is an electrical engineer and has worked in computers and data communications for over 30 years. He has also been a member of the Moorestown Council for 8 years, and spent 4 years as the mayor of that town. He has a Certificate in Municipal Planning from Rutgers University. He belongs to the Rotary Club, the Philadelphia Union League, the South Jersey Chamber of Commerce Foundation, and the Executive Committee of the South Jersey Chamber of Commerce. He is the Founder and President of the New Jersey Music Society, and he is a member of the Camden Institute of Medical Research, the Philadelphia World Affairs Council, and the Wetlands Institute.

RCA AND THE SOUTH JERSEY EXPERIENCE

Mr. James E. Palmer
President Telenex Corporation
Chairman, South Jersey Foundation



PALMER: Thank you very much.

It truly is an honor for me to be here. I can't express what a thrill it was to have participated in the Orbit '81 program even in the small way that I did and the thrill it is to have been invited to speak to you.

I'm here as a volunteer. It is only through volunteers and public support that programs you are contemplating can truly be successful. It is those ingredients--volunteers and public support--that the South Jersey Chamber Foundation brought to Orbit '81.

Tom Chavis has already described the genesis of Orbit '81. I am now going to summarize the Orbit '81 experience. The trip to Cape Canaveral was one of the most gratifying experiences I've ever had. The enthusiasm of the young people for this project was unbelievable, and it was demonstrated at every turn. The bus they traveled in was their billboard, and they carried it up and down the east coast with them to show their pride in what they were doing.

Orbit '81 students had experiences that most young people never have. They appeared on the Today Show, they were invited to the White House, they met astronauts; but most of all they designed, built, tested, redesigned, rebuilt, and retested the ant colony experiment with their own minds and hands. Of course, after the launch a post mortem (in this case that is literal as well as figurative) had to be carried out. The ants died, but the project was a success.

The death of the ants was the result of dehydration during the waiting period preceding the launch. The students determined that, too; they were sad but enthusiastic, wrapped up in what was now teaching them the frustrations, the thoroughness, the patience, the honesty of good science. The ants died, but the spirit of Orbit '81 did not; the South Jersey Chamber Foundation is trying to keep that spirit alive.

The role of the South Jersey Chamber of Commerce and its Foundation was to provide a focal point for public support. The various chambers of commerce have foundations which permit them to accept tax exempt contributions. We were also there to compile a record of what happened and to provide the means, we hope, for replication of the experience.

We have, in fact, compiled the record and begun the process of replicating the experience through our 4-year space science curriculum which presents the Orbit '81 program in detail. Prepared by Fred Reese, the faculty advisor to Orbit '81, that curriculum has been approved by an educational review board assembled from educational institutions and organizations in the Southern New Jersey area. We are seeking to sell the curriculum, but our purpose is not primarily to raise money. Rather, we hope to stimulate interest in other projects of this kind. We look on the curriculum as a prototype, and we think it offers an opportunity for creative innovation in the pursuit of other projects like Orbit '81.

One of the Orbit '81 progeny is the space camp we sponsored this past summer at Rutgers University. The idea originated with the South Jersey Chamber President, Leighton Williams. The camp was organized entirely by volunteers with staff help from the Chamber and was directed toward middle-schoolers entering the eighth grade. It was held at a Rutgers University inner-city campus in Camden, New Jersey, and activities ranged from hands-on demonstrations of space hardware to computer programming to actual rocket firings. There were field trips to the Smithsonian National Air and Space Museum in Washington, D.C. and to the Forrestal Laboratory in Princeton, New Jersey, where research is being conducted on thermonuclear power. Once again the enthusiasm of the young people--there were 45 of them--was exciting and contagious. We even had graduation exercises and gave out diplomas.

The South Jersey Space Camp was, in fact, a smashing success. Except for a few of us who had forgotten what it's like to deal with 13 year olds, it was, I think, as enthusiastically enjoyed by the administration and faculty as by the students. Attendance was by invitation, with students selected by school administrators and faculty members in the three counties around Camden. Forty-five invitations were extended, and scholarships were offered by local industry to qualified students of lesser means. For others, the tuition was \$200.

Now, why did it all work? Why did both of these programs work? Well, first, they were romantic. They were media intensive and therefore very attractive to young people.

The Orbit '81 experiment was unique. The experiment was scientifically significant. There was a real potential for producing new knowledge.

It was new. It had never been done before. It was not just an ordinary classroom experiment.

It admitted wide participation. It involved a broad cross-section of the student body and included many disciplines. Everyone got into the act, and participation became a status symbol. It was goal oriented. There were schedules and deadlines that had to be met, and there was no such thing as not meeting them because when the Shuttle went, it went. If the ants weren't on board, the project was a failure.

I believe that there is generic applicability for what happened in Orbit '81. It doesn't have to be restricted to space science. Experiments in particle physics, oceanography, and nuclear science all meet the criteria I've set forth--and they are practical. I challenge your ingenuity and creativity to find other areas of science and engineering in which these principles can be applied to further the coalition between the industry and education.

What do you need to accomplish this? First and foremost, you need a good project. In addition, you need a willing sponsor, such as RCA. Next, you need a willing educational institution, such as the Camden school system, and you need a public focal point, such as the South Jersey Chamber Foundation. And surely you need prime movers, like Tom Chavis and Leighton Williams, who made certain that what had to happen, happened. They didn't depend entirely on the volunteers or the students to make sure that what had to be done was done. Finally, and I think I would put this at the top of the list, you need enthusiasm. I closed our space camp by noting that while experience may be the refining fire that transforms talent into ability, and while knowledge and hard work are necessary too, the catalyst that ultimately enables those ingredients to produce success is enthusiasm. We certainly saw enthusiasm at work in the Southern New Jersey Space Camp, we've certainly seen enthusiasm at work in this conference; and I submit to you that with the leavening of enthusiasm, you can rise to any height you wish. I offer that as your challenge.

ALLIANCE IN THE NATION'S CAPITAL

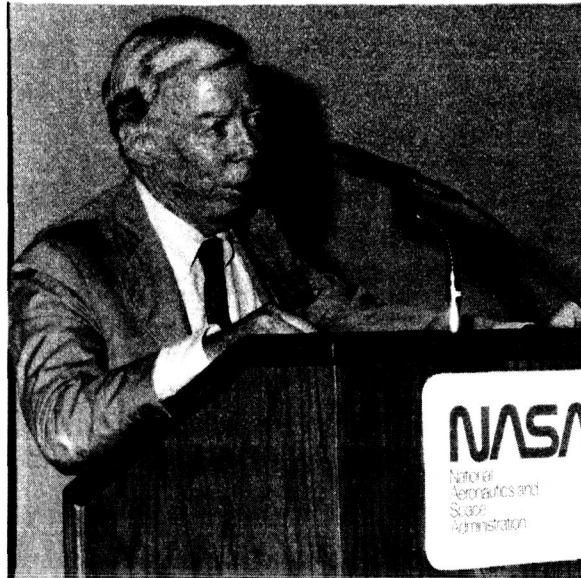
Introduction of Mr. Theodore D. Drury

BOYLE: There are other people who have bridged the gap between the technical and the nontechnical societies. Our next speaker, Ted Drury, is one of them. He received a technical education at Virginia Polytechnic Institute and State University and holds an Arts Degree from Princeton University. After college, he became a staff writer for the St. Louis Globe Democrat. Later, he was an associate editor of The Nation's Business. He worked in the Office of the President in the Office of Economic Opportunity. There he was Chief of Publications of the Kiplinger National Newsletter. He was also Special Assistant to Senator Stuart Symington. And from 1971 to 1984, he was Associate Director for Public Programs for the National Science Foundation

He is now Director of the Science and Math Education Project for the Federal City Council.

ALLIANCE IN THE NATION'S CAPITAL

Mr. Theodore D. Drury
Director, Science Math
Education Project
Federal City Council



DRURY: During its first year and subsequent months, the Science and Math Education Project has demonstrated that a volunteer corps of scientists, mathematicians, and engineers can be recruited to help improve science and math education in the public schools.

More than 240 persons from 40 organizations have responded to the recruiting drive, and 160 have received assignments in the District of Columbia public schools. They are placed by the school system's Volunteer Services and Training Branch on a continuing basis during the school year. Most of the volunteers have doctorates or master's degrees.

More than 1,300 students were helped by volunteers in such activities as classroom talks, coaching for science projects, tutorial aid, field trips, and science and math clubs.

Volunteers provided direct aid to 160 teachers in workshops, seminars, and field trips, and support to 58 teachers through technical assistance such as lesson planning. Indirect services were provided to 138 teachers through films and other teaching materials.

Volunteer investment of time ranges from that of a retired computer specialist who has been spending 4 hours a day, four days a week at his school, to volunteers who devote 2 hours monthly to sponsor science and math clubs or act as guest lecturers.

Frederick J. Ryan, Jr., Deputy Assistant to the President and Director of Private Sector Initiatives, has endorsed the project as an "outstanding public/private partnership" and pledged White House support. A formal evaluation to determine the effectiveness of the project is being conducted by Richard N. White of the Bureau of Social Science Research under a grant from the Aetna Life & Casualty Foundation.

An interim assessment of the project by Mr. White states that as a new, unusual enterprise, "the operation of the project may confidently be judged as a success." Data collection to determine any change in student attitudes on science and math is still under way, so that assessment will come later. Steps are being taken to address problems encountered so far--such as the need for an automated data base, and better training of some teachers and volunteers on how to form more effective partnerships.

To trace the background, the Science and Math Education Project is an undertaking of the Federal City Council in partnership with the D.C. public schools. The council is a non-profit, non-partisan organization of civic leaders in business, education, and the professions.

A volunteer corps of scientists, mathematicians, and engineers is being recruited to help with science and math education on a part time basis in the D.C. schools, and to assist teachers in upgrading their professional capabilities. The purpose is to help alleviate the severe shortage of qualified science and math teachers which afflicts the D.C. schools and schools across the country. The project is intended to form an experimental model which can be replicated in other cities.

The Science and Math Education Project has already attracted the interest of a number of national organizations. This interest springs from a recognition of the project as a workable model to help remedy the severe national shortage of qualified science and mathematics teachers at the precollege level.

Interested organizations include the Mathematical Sciences Education Board, an arm of the National Research Council; the Triangle Coalition for Science and Technology Education, sponsored by the National Science Teachers Association; the Conference Board of the Mathematical Sciences, composed of the presidents of the leading math societies; the Institute of Electrical and Electronic Engineers; the Aerospace Education Foundation; and the American Institute of Aeronautics and Astronautics.

Oversight and guidance is provided by a task force composed of interested Federal City Council trustees and top D.C. school officials. The Chairman is Thomas G. Pownall, Chairman and Chief Executive Officer of the Martin Marietta Corporation; John L. McLucas, former Executive Vice President and Chief Strategic Officer of COMSAT, is Vice Chairman. The project is directed by Theodore D. Drury, who has been detailed from the National Science Foundation to the Federal City Council under the Intergovernmental Personnel Act.

Initial funding for the project has been provided by the Eugene and Agnes E. Meyer Foundation, Philip L. Graham Fund, Morris and Gwendolyn Cafritz Foundation, Hattie M. Strong Foundation, Aetna Life & Casualty Foundation, and the D.C. public schools.

Organizations involved in helping with the project are:

Catholic University
University of Maryland, College Park
Georgetown University
George Washington University
University of the District of Columbia
American University
Howard University
Martin Marietta Corporation
COMSAT
Control Data Corporation
The Smithsonian Institution
National Aeronautics and Space Administration
National Institutes of Health
Potomac Electric Power Company
Washington Gas Light Company
C & P Telephone Company
American Management System
IBM
System Planning Corporation
General Research Corporation
Atlantic Research Corporation
EG&G Washington Analytical Services Center, Inc.
Rockwell International Corporation
Naval Research Laboratory
Harry Diamond Laboratories
American Petroleum Institute
U.S. Army Corps of Engineers
Naval Facilities Engineering Command
Military District of Washington
National Space Club
American Institute of Aeronautics and Astronautics
Electronic Industries Association
Institute of Electrical and Electronic Engineers
American Association of Retired Persons
The Retired Officers' Association

National Society of Professional Engineers
Society of American Military Engineers
Association of American Railroads
Washington Operations Research Management Science Council

A needs assessment for volunteer help in science and math was made, and volunteers are involved in the following activities:

- Giving demonstration lessons in everyday applications of science
- Tutoring gifted students in science and math
- Sponsoring clubs and competitions in science and math
- Conducting seminars and workshops for science and math teachers
- Hosting field trips for students and teachers

Placement is a time-consuming operation which involves matching each volunteer's preferences, areas of expertise, and time constraints with the school system's needs.

The project focused first on the seventh grade. Research supported by the National Science Foundation has shown that it is in this general age bracket that students develop either an affinity or a dislike for science and math. This appears to be a critical point where an effort to encourage an affinity for science and math would have the greatest impact. In response to requests from seventh and eighth grade teachers, and some high school and elementary teachers, the growing number of volunteers has made it possible to expand to these grades earlier than was planned.

During the summer of 1985, a carefully picked team of science and math teachers and volunteers took part in designing the joint volunteer/teacher program for the 1985-86 school year. The overall program follows the essential activities already outlined.

A four-week summer institute for 24 junior high school science and math teachers and 24 sixth grade teachers took place in July. Operated by volunteers, the institute was aimed at helping the teachers become more effective in using science, math, and engineering volunteers as a valuable resource in the classroom. In addition, volunteers took part in a summer Mathematics/Science Enrichment Program which was designed to encourage students to consider careers which require a math and science background.

Current and future plans are being developed by a coordinating committee made up of the school officials in charge of instruction, volunteer services, staff development, and school improvement. This is intended to ensure that the project is fully integrated into the school system as an on-going activity.

The project will be expanded in the D.C. schools from its original focus on seventh grade with some volunteers in adjacent grades. Both students and teachers in the fifth and sixth grades benefited greatly from the volunteers assigned there, and efforts will be increased in those grades. There will continue to be expansion in the eighth and ninth grades.

Activities aimed at enhancing teachers' knowledge and abilities will be increased. These will include seminars and workshops on various aspects of science and mathematics given by volunteers for the teachers. As one example, there is planned a math/science enrichment series for junior high school teachers, with at least four seminars on science and four on math in each of the school system's four regions. Given by volunteers, these will be based on teacher response to a survey of desired subject areas.

With the increasing popularity of science fairs, every science teacher will receive instructions on how to best use volunteer coaches for students with projects. Volunteers will be encouraged to act as coaches and judges at science fairs and other science and math student competitions.

A Professional Resource Assistance Catalog will be developed, listing available volunteers and their expertise and skills. This will make it possible for teachers to make direct initial contact with volunteers.

The next logical step in the development of the project will then be taken--exploring its potential as a working model which can be replicated in other cities. A booklet will be developed to explain how to organize and manage such a project. It will be based on the experience gained in this project and in the formal evaluation which is being conducted. This booklet will be available as a response to inquiries and also for distribution through interested national organizations.

Information about the project will be disseminated through the news media and the journals and newsletters of professional societies in science, mathematics, engineering, and education.

In summary, the project has demonstrated that highly qualified volunteers can be recruited from universities, business firms, and government agencies. The recruiting effort will be continued to support the broader program in the current school year and subsequent years.

The next question is how effective volunteer scientists and engineers can be in encouraging students to develop an affinity for science and math and in helping teachers upgrade their professional capabilities. Anecdotal evidence to date indicates that the project is having a positive effect, and the evaluation now under way will provide a more definitive answer.

CHILDREN'S SCIENCE CONFERENCE

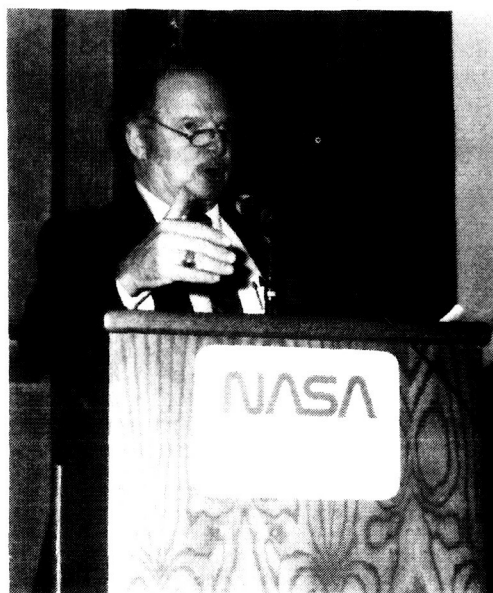
Introduction of Dr. Charles LaRue

BAILEY: Dr. LaRue has a Ph.D. in Science Education, Zoology, and Botany and a Master's Degree in Zoology and Botany from the University of Maryland. He earned a B.S. in General Science from Wilson Teachers College in 1951. For the past 15 years, he has been the Coordinator of Elementary Science in Montgomery County schools. He has been responsible for the development of a program of studies and instruction for the K-8 Science Instruction Guide, and is a co-author of a set of cassette learning packages for individualized learning experiences in the elementary schools.

Dr. LaRue has co-authored papers and reports with Paul Brandywine in 100 investigations in laboratory science. He serves as a consultant for educational filmstrips and books for the National Geographic Society, and has recently authored a biology book for special education.

CHILDREN'S SCIENCE CONFERENCE

Dr. Charles LaRue
Coordinator, Elementary Science
Montgomery County Public Schools



LA RUE: I am especially glad to be here. I am almost a fish out of water. I am an elementary science educator. The fact that I am in K-6 science puts a special burden on me. At the same time, it gives me a special privilege and purpose for talking to you. I would like to share with you today, in three or four steps, an elementary school program that took place this spring during National Science Week. On Saturday, May 17, at the direction of the Board of Education of Montgomery County Public Schools, one of our three administrative areas celebrated National Science Week with a conference for children on science and technology. It was a unique experience, perhaps one of a kind--and maybe something that you will consider thinking about and working on in the future. I will describe that conference to show you what happened during one day in the life of children as they attended their own "mini-national" conference. It is the same kind of national conference that you attend regularly, with a keynote speaker, work sessions during the day, lunch with your colleagues, an exhibit hall with vendor booths to pick up the latest information, and a final wrap-up speaker at the end of the day. To begin, you will see the participants in action, and then I am going to present some papers prepared by the conference staff so that you can take their experience back with you. Your visual images of the people and the handouts should serve as an overview and outline of how the team put the conference together and carried it out.

At the outset, there was a letter from Dr. Powell, the Associate Superintendent of one of our administrative areas. In that letter, she described some of the action that had to take place in order for the conference to happen. The Board of Education passed a resolution that acknowledged National Science Week (May 12-17, 1986) and in particular, National Science Week in Montgomery County Public Schools. That letter and other papers are included as models for those of you who may want to become involved in a similar enterprise. The purpose of the material is to provide a "program learning packet" to begin your own elementary science program for the next National Science and Technology Week in 1987 (April 5-11).

The second item in your materials packet is a copy of the Children's Science and Technology Conference Agenda. The keynote speaker, Dr. Allen Schneider from the U.S. Department of Education, was an important element, an inspiring speaker selected by the conference chairperson. You will learn about the variety of organizations that took time to be involved. Those organizations were contacted by the staff in the school system after brainstorming about who might be of assistance and might want to be involved in the program.

The selection of the keynote speaker from the U.S. Department of Education proved to be a plus. A very stimulating and highly charged person, Dr. Allen Schneider conveyed the message that you can do anything that you choose to do--you need only make up your mind that you are going to do it. He had an audience of more than 350 youngsters on a Saturday morning. Students from grades 4, 5, and 6 were required to be accompanied by one parent, or a "significant other." The audience of more than 700 heard Dr. Schneider, a published poet, talk about the way life is, that you can make up your own mind to accomplish something, and that you have got to get yourself up in the morning and charge out and do what you have decided to do. Dr. Schneider used humor and audience involvement to make his major points about "choices" available to pupils. The initial speaker can set an up-beat tone and topic for the entire conference. The county school system now has a Resource Connections Bank, which provides an up-to-date list of volunteers, mentors, places to go, and things to do. Concern with business, industry connections, and ways to work on cooperative efforts gave rise to an on-line operating project. Last year it was in two or three high schools, and it is now going to be in all of the high schools and some junior high schools. The Resource Connection Bank is being programmed for elementary schools in the years ahead. (That is generally the way elementary schools are funded--a sort of hand-me-down system.)

At 12:30 to 1:00, a balloon launch was included as part of the National Science Foundation Week Program. Finally, a "hands-on-science" speaker at the end of the day performed a large number of exciting chemistry experiments at which the audience "ooohed" and "ahhhed". The speaker showed the kinds of things that can happen when you deal with the wonder and bold beauty of nature, and the wonder and beauty of the interaction of elements and ideas. Participants left on a high science note.

The next item in your packet is a student selection sheet. The whole day's program was selected by each student. A child came to the registration desk to pick up his packet, with his name on the corner and a name tag to make him feel very important. In the packet was his complete registration--who the instructor would be, and what room he would be in. A very thorough and neat job was done by the people at the local area office. There was an agenda of distinguished presenters and the current, exciting topics they presented. From NASA moon rocks to ecology and from the strength of metals to a tree classifying computer problem, to "go fly a kite."

Typical of the day's scene was child-adult pairing. This was a special crowd, a unique crowd, because it is made up of an adult and a child--a design to provide for a shared experience that is basically hands-on. A lot of things were going on across each time slot; in each time slot, a parent/child situation was taking place where a piece of the everyday world was being explored.

The intensity of the parent/child interest was the key note of the day. For example, there was an instructor who volunteered to work at the Saturday conference. The instructor is a science specialist for the school system and has received NASA training in the moon rock program. Montgomery County Schools have shown moon rocks to thousands of elementary school children. If you are familiar with that program, you know that you need to belong to the Brinks Armored Car Company in order to handle moon rocks.

A representative from a rather large electronics communications firm with offices in Silver Spring and Wheaton talked to the youngsters not only about basic back-packing equipment, but also about everything they needed to know for survival in the wilderness. A research chemist from the National Bureau of Standards demonstrated a program on the analysis of food. She showed the content of caffeine in cola and tea as well as the nutrients in milk. From the Silver Spring Railroad Society, presenters fascinated groups with how to run model trains.

A regular member of the Montgomery County Public Schools performed a demonstration on reptiles of the world. "Snakes of the World" is full of interesting information about a number of specimens. He is a professional herpetologist who knows how to handle and keep reptiles. The presenter wore a "Science is Fun" badge, like the one I have on today. Each child was provided a badge by the National Science Foundation (NSF) for National Science Week. Entrepreneurs in our school system called NSF and obtained badges for all the participants.

One of the most fascinating activities of the day had children and parents studying the physics of bubbles. They learned about surface tension and how bubbles are made. How can soap be scientific? If you have never before done "bubbles," it is very exciting. Using a bubble machine one can make a film and just blow gently through it. Bubbles form and are pushed out the other side.

There was also a program involving participants in the use of micro-computers in providing a simple plant identification key. The participants had a chance to "key out" about 12 selected plants, using the computer. A father and a son, or a mother and a daughter are problem solving together. The purposes of the conference were to motivate students in the area of science and technology--to motivate them through hands-on experiences--and to expose children and their parents to some specific applications of science.

A real concern was to create enthusiasm and wonder about science. A lot of the speakers and presenters were selected teachers and teacher specialists who have a natural leaning toward science. It is part of their regular job to convey enthusiasm and encourage interest in elementary science.

Projects were exhibited by students in the gym. They were asked to bring in their science fair projects from the Science Fair held in April. The elementary youngsters had a chance to see some junior high and senior high projects.

An increasing number of fourth, fifth, and sixth grade science exhibits or science fairs are currently being held. Most of them are non-competitive. Many of them are simply spring fairs or assembly programs at which children show materials from the different curriculum areas that are studied.

There has been an increase in "science fairs" across the country, particularly in the Washington, D.C. metropolitan area. An award program took place at the Howard B. Owens Science Center, named after Howard B. Owens, the originator of the science fair movement in Prince George's County. The projects were reviewed and judged and prizes given. In addition, the finalists in each category made oral presentations to a panel of judges whose job it was to select 1st, 2nd, and 3rd places, in addition to the "grand prize" winners from among the finalists.

Also displayed in the exhibit hall were a selection of books for parents and children. Three hundred of the latest books were brought in from the Montgomery County Public Schools Department of Instructional Resources. Parents expressed particular interest in the book exhibit.

I am glad the program covered such a wide range of ages and topics. I would like to emphasize that, as very often is the case, we heard about robbing Peter to pay Paul (in reference to providing for gifted and talented programs). The point was made that the budget for gifted and talented programs may have to come out of the regular school budget. The regular program is often drained of resources to provide special programs. The business community needs to be made aware of the way it works in education. Very often we rob Peter to pay Paul. I would like you to think beyond the seventh grade through twelfth grade programs that you heard about yesterday and today, and focus for a few minutes on elementary education. There are a lot of schools and a lot of school systems that have strong elementary school science programs. The curriculum work of the 1960s and the 1970s saw the development of new programs for elementary science. In many respects, the movement has also sent a message to textbook publishers. Their programs have to be more than just a textbook; they must offer a classroom program that involves hands-on science. So classrooms must become activity oriented and present problem-solving events.

Industry and business are also becoming more outspoken and more involved. The program described here is just one of 15 or 20 that involve elementary school children. In Montgomery County, some aspect of business or industry or government is involved in many school programs. We have a very strong relationship with the National Bureau of Standards because of its location in Montgomery County. The Public Health Service, the National Institutes of Health, Montgomery College, the University of Maryland, Harry Diamond Laboratories, and NASA are just some of the resources that are helpful.

Let me conclude by saying that our main purpose, motivation, seemed to work because everybody asks when the next conference will take place. That is seen as good attainment of an instructional objective. If someone asks to continue or to have some more of a topic, subject or activity, we say that is good. I used to say that if somebody took one of my biology books from my desk and I never saw it again, I had really accomplished a good instructional objective. I caused somebody to really want that book. Rather than be disgruntled about it, I would smile and say, "I will get another book somewhere else. Let somebody have that one."

I think that the feedback we received from the staff and participants said to us that there was a positive self-image for children on that day. That image needs to be reinforced. Children felt good about being thought about, about being looked at as somebody important, and we know that the parents felt the same

way. Parents had an opportunity to be involved directly in a school program where they were welcomed 100 percent. Parents needed to be there.

You must look for sources and resources. This program had part of its seed in the business community in the Science Weekly Magazine where first talks included information from that source. After initial meetings, the school system personnel from the Area Administration Officer took over.

The remaining half of your packet refers to the roles of various people. Consider this conference for children idea, and think hard about it. At the end of your packet is a teacher/presenter handout. As people left the conference, they had one piece of paper that rang a bell. This handout about building structure from sugar cubes serves as a reminder of the whole experience, the triangle: teacher, parent, child. So too, when you go home, the handouts will serve to remind you of an elementary school program that will raise interest and enthusiasm for science. Tomorrow's work force hinges on such interest and enthusiasm.

PARTNERSHIPS IN SCIENCE AND TECHNOLOGY EDUCATION

Dr. John Fowler
Director
The Triangle Coalition



FOWLER: It is a privilege to be here. I am always embarrassed when my record of academic vagrancies is presented and the audience realizes that I haven't been able to hold down a job, but it does make the point that I have been here before; that I was involved in the post-Sputnik flurry over improving science education. It has been very interesting and instructive to see some of the differences between the 1960s and 1980s, and to recognize that we are proceeding differently this time. I think you will agree that we accomplished our 1960s goal of creating more and better scientists and engineers. In the process, however, we opened a wider gap between the scientists and engineers and the rest of the population. In this new reform movement which began with the "Nation at Risk" in the early 1980s, is an attempt to close that gap. We are now setting as a goal bringing all of the student population, the public of tomorrow, enough understanding of science and technology to allow them to be comfortable and productive in the new world.

A study sponsored by the National Science Foundation reported this spring that 28 percent of the adults sampled really have little understanding of what is meant by the word "molecule." That is a useful indicator. Forty percent believe that some numbers are lucky, 46 percent disagree with the theory of evolution, and 70 percent don't have a clear understanding of radiation. This is a large percentage, and you know as well as I do how crucial that knowledge is today. I think the motivation for this new reform movement is the realization that there is a tremendous gap which must be closed.

Some new concerns are surfacing that do go back to the 1960s goal. As we were setting up the Triangle Coalition, we were told by personnel people at DuPont and other major industries that they are getting good scientists and engineers now. Scientists and engineers are not our worry, they said. "We are worried about the work force, the technical people that come in at lower levels and the public that we have to deal with." But that has changed, and we are

beginning now to worry about the scientists and engineers. Decreased student enrollment will be evident in high schools in 1995. Those of you who worry about hiring scientists and engineers will have a smaller talent pool to draw from. Within that pool, the percentage of white males is decreasing. Minority populations are growing. In the 1990s there will be many states in which the minorities are the majorities in the public schools. You will be drawing on a talent pool in which Blacks and Hispanics account for as much as 40 percent and which also has a high percentage of females. This is just the population that science and mathematics has done very badly with. The Triangle Coalition is concerned with getting more blacks, hispanics, and women into science and engineering.

To review what has happened since the flurry of reports over the past few years, many of us were concerned that the attention to education was going to get into some kind of cycle. Education would be in focus for a couple of years and then public attention would wander. But this cycle has lasted. Concern over the state of U.S. education and, in particular, over science and mathematics has remained strong. There is reason to hope that we are putting this concern into our priority structure in the way we dealt with environmental problems. Environmental problems used to come up and then disappear, and then come up again, but we finally built them into the national consciousness. If you are a real optimist, you can hope that education has reached that state.

There are some "second round" reports which have come out.

RECENT REPORTS OF INTEREST

1) A Nation Prepared

To order, the following information must be given: name, title, institution, address, city, state, zip and telephone number. Make check or purchase order to Carnegie Forum on Education and the Economy and mail to:

Carnegie Forum on Education
and the Economy
P.O. Box 157
Hyattsville, MD 20781

2) First Lessons: A Report on Elementary Education

To order, write to:

U.S. Department of Education
Washington, DC 20208

3) Investing in Our Children

To order, write to:

Committee for Economic Development
477 Madison Avenue
New York, NY 10022

4) The Harris Initiative for Quality Education

To order, write to:

Harris Corporation
1025 W. NASA Boulevard
Melbourne, FL 32919

The report A Nation Prepared, from the Carnegie Forum on Education and the Economy, looks at teacher professionalism. Another excellent report, First Lessons from the Department of Education, focuses attention on elementary schools in a very interesting way. Investing in Our Children is a call to business to become involved, and is a good example of the kind of partnership action between industry and education.

The challenge before us now is to take all of our students a little further into science than we ever have and to make science and technology a part of the intellectual currency of this country. This is a much more difficult challenge than we faced in the 1960s. The response that I want to talk to you about is a very modest one, because it is a "structural" response. Although most change occurs at a local level, a national organization that increases communication and therefore increases efficiency, and focuses national attention on specific opportunities is very useful.

We called some representatives of the groups that we thought should be involved together and asked them whether a national coalition would be useful. They said yes, and we have been putting together such a coalition. We call it the Triangle Coalition for Science and Technology Education. The three sides are: (1) business/industry/labor, (2) science and engineering, and (3) education.

The coalition has been in existence since April 1985. The following is a list of its present members.

Member Organizations as of October 21, 1986

Science and Engineering - Glenn T. Seaborg, University of California-Berkeley

Acoustical Society of America
American Association for the Advancement of Science
American Astronomical Society
American Chemical Society
American Geological Institute
American Institute of Biological Sciences
American Institute of Physics
American Nuclear Society
American Physical Society
American Society of Mechanical Engineers
Federation of American Societies for Experimental Biology
Institute of Electrical and Electronics Engineers
Junior Engineering Technical Society, Inc.
National Association of Academies of Science

Business, Industry, and Labor-Robert C. Forney, E.I. Du Pont de Nemours & Co.

AMOCO Corporation
Apple Computer, Inc.
Chevron, U.S.A., Inc.
Cray Research, Inc.
Edison Electric Institute
E.I. DuPont de Nemours and Company
Exxon Research and Engineering Company
Ford Motor Company
General Electric Company
Hewlett-Packard Company
International Business Machines Corporation
Merck and Company, Inc.

Education-Mary Hatwood Futrell, National Education Association

American Association of Physics Teachers
American Federation of Teachers
Association for the Education of Teachers in Science
Council for Elementary Science International
Council of Chief State School Officers
Council of State Science Supervisors
International Technology Education Association
National Association for Research in Science Teaching
National Association of Biology Teachers
National Association of Geology Teachers
National Council of Teachers of Mathematics
National Education Association
National Energy Foundation
National Institute for Work and Learning
National Science Supervisors Association
National Science Teachers Association
Native American Science Education Association
Science Service, Inc.
Technical Educational Research Centers

This is an open coalition. Any national organization with a commitment to improvement in science and technology education is welcome. We had about 20 members when we started in the spring of 1985, and we have close to 50 now, with a nice division among the three sides of the triangle. We have not yet actively recruited business, industry, and labor. Those we have as members organizations heard about us and came to us. We are however recruiting now. We are a decentralized organization, and we are hoping to spin-off most of the things we do. We have a small staff located at the National Science Teachers Association, the host organization. The core operations are funded from membership assessments. These organizations pay an annual membership assessment which supports staff, task force meetings, steering committee meetings, and so forth. Other activities and projects are supported by external funds, and I think we have started out successfully. With about \$80,000 or \$90,000 of core money, we are leveraging more than \$200,000 of project money in the beginning of our second year.

What do we do? You have heard enough of structure. I can give you some insight into that by listing the task forces.

TRIANGLE COALITION TASK FORCES

- 1) Local Alliances
- 2) National Science Week
- 3) Elementary Science Education
- 4) Educational Technology
- 5) Congressional Liaison
- 6) Public Understanding
- 7) Joint Committee in Teacher Internship

We operate through task forces of representatives from Triangle Coalition member groups. We provide for other communication through a yearly membership meeting and, in the last 2 years, through major national conferences. We are setting up an electronic bulletin board so that each organization can keep the other organizations informed of what they are doing in science and technology education.

At Triangle, the teacher is the focus of our attention. We are trying to mobilize resources for the science teacher so that he or she can do a better job in science and technology education.

We have had seven task forces. One is working to form a network out of the various local action groups around the country. I will say more about it later. A task force has participated very strongly in National Science Week and has worked very closely with the National Science Foundation. We just held a conference on elementary science education. We are setting up a task force to advise the Triangle Coalition in the area of educational technology, and we are using people in our organizations with contacts in Congress to set up a "congressional liaison task force" that will keep us advised about what is happening at that level. We are moving more slowly in the area of public awareness and public understanding. We have a joint committee working with the people on the West Coast on teacher summer internship opportunities.

Let me discuss in more detail two task forces. First, National Science Week. We operated on the Eureka Principle, "Eureka, there is a good idea." We had the idea for the National Balloon Launch for '85 Science Week. We had ten sites around the country at each site we sent up 500 balloons with cards attached at the same time on one of the days of National Science Week. We got the cards back and then sent back to the sites the cards that we had collected, along with a brief analysis of where the balloons had gone and why. It was a lot of fun. We said, "Let's do it again in '86." We made the mistake in '86 of publicizing it. We sent up 5,000 balloons at ten sites in '85. In '86 we had 200,000 balloons and 700 sites. We learned by our mistakes. We had the opportunity to make a lot of them with that kind of expansion, almost two orders of magnitude. It was very exciting, though. We could have sent up half a million balloons if we had had them.

This project had private sector funding; Worldbook-Childcraft put a significant amount of money into it, in addition to DuPont and the National Science Foundation. A lot of volunteer effort went into it. At each site we got back about 8,000 cards. We have picked 40 or 50 sites out of the 700, and sent the cards to the U.S. Geological Survey, Division of Place Names. They put them into a program that located the latitude/longitude of the launch site and the finding site, and then plotted a vector on a map that shows how far the balloons traveled. The record holders went about 700 miles. One of them, actually, went from Portland over the mountains into Montana. We had some very interesting data there.

In addition, an atmospheric research scientist at Colorado State heard about the project and asked for all the cards. He is now analyzing them, and we can tell the kids that they participated in a research project. We will do this again next year. National Science Week in '87 has at our urging been moved up, and it is now scheduled for April 5 through 11. There will now be time to get data back to the classes before summer vacation.

Perhaps more in keeping with the interests of this audience is our Local Alliance Project. We recognized early that around the country many local groups are forming and becoming active. You have heard about some: the New Jersey experience, for instance. A group of local community leaders in business and industry, science and education, get together to do something to improve science and math education and in some cases to improve education in general.

We brought representatives of those groups together in the summer of 1985 and asked how we, as a national organization could help. Based on their response, we made a proposal to the Carnegie Foundation. We now have money to help the existing local groups, link them into a network, and help form more local groups around the country.

We have set up a clearinghouse of local groups which now includes 100 names. We publish a newsletter to join those groups. We have a handbook-entitled "How to Form and Operate a Local Alliance." We have set up a consulting service composed of people who are experienced with local alliance building and will be able to meet with new groups. We also plan 6 regional conferences which will bring together teams from different areas and give local groups guidance through workshops and panels.

Let me end by saying a little bit more about the elementary conference held this summer. I think that if you really look at the problem that we are facing, particularly in science and math education, you must turn the pyramid upside down. The place to begin is the elementary schools.

Let me go back to the point I made earlier. If I interest you in helping based on altruism, on the premise that we need to have a country in which everybody is comfortably productive in science and technology, then I will tell you that you are not going to have a work force unless you do a better job than you have been doing. We have been able to populate science and engineering at the upper level, out of the white male population, for the most part. We have important talent from India, Korea, and Taiwan. But the pool is shrinking. As I said earlier, in 1995, 40 percent or so of college age students will be black or Hispanic. Now we must ask how can we tap the pool in 1995.

One possible approach is that of NACME (the National Action Council for Minorities in Engineering). They work very hard with high school students and try to turn a few blacks or hispanics from medicine or law into science. But that is too late. Data show, and the Urban Coalition project is designed to work on, the fact that science and math in the first three years is a critical filter for women and minorities. You should direct your attention to the elementary level. That is the crucial level. It is the hardest place to work from the point of view of a national organization, but it is the critical level. Right now, blacks make up 10 percent of the work force, but only 2 percent of scientists and engineers. Hispanics are 5 percent of the work force, and in science and engineering they are 2 percent; only 13 percent in science and engineering are women. So there is a lot of improvement that can come about.

What can be done about this problem? We think that our local alliances are an extremely important resource. We think that we can give them information and suggestions for ways they can directly help teachers and local schools. We are planning to put together a "local action package."

Our conference this summer was one of three on elementary issues. There was a very important conference at the Smithsonian earlier in the year, and in October 1986 there was a conference co-sponsored by the Triangle Coalition and the Johnson Wax Company at Wingspread in Racine, Wisconsin.

PANEL

Introduction of Ms. Kathleen Snyder

BAILEY: I am pleased to introduce the moderator for this panel discussion. Kathy Synder is a Special Assistant to the Superintendent of Schools for Prince George's County. She has a Bachelor's Degree in Journalism from the University of Maryland and a Master's Degree in Public Relations from American University. Ms. Snyder worked as Public Information Specialist with the school system for several years before taking on her present responsibilities as Coordinator of the Business and Industry Coalition for the county. She reports directly to the Superintendent.

Ms. Snyder will discuss the Prince George's County program in a little more detail before taking questions for the panel.

PANEL

Moderator: Ms. Kathleen Snyder, Special Assistant
to the Superintendent
Prince George's County Public Schools

Ms. Kathleen Snyder
Special Assistant to
the Superintendent
Prince George's County
Public Schools



SNYDER: The role that I play for the school system is interesting. It is definitely a partnership role. In the Prince George's school system, we are not going out to our business community asking for money. What is more important to us is time and expertise. The people who had worked with Orbit '81 gave so much of their time and effort that they made that project succeed. We have been successful in Prince George's County because we have had the willing partnership of 80 of the leading business people to work with us to form effective partnerships.

The teacher recruitment effort was especially successful in our county. Dr. Murphy noted that we had 7,000 applicants for 400 jobs. We suspect that the technique we used last year will be duplicated by Montgomery and Fairfax and other counties in the future. This year we are taking the next step, a career education task force, which will involve business people more than it will involve educators. We want to identify the employability skills our students need in order to succeed in the work place. We want to draw in the leading business people of the county to work with us in identifying those particular skills. That will have a major impact on the curriculum at the high school level. I am not just talking about basic reading, writing, and arithmetic, but basic employment skills: how to get a job interview, how to dress for interview, what kinds of basic job skills are needed. People complain that our students do not know how to use a two or three button phone. There are a lot of concerns about the students' ability to communicate well. Those are the kinds of skills we will examine. We want to bring the students to a better awareness of the kinds of jobs that are growing, not only in Prince George's County, but in the whole metropolitan area.

We are also looking at programs to expand teacher awareness. This summer we hope to initiate a summer employment program for our teachers. We hope to identify 500 professional level jobs for our teachers. Lockheed in California has been particularly helpful. Their program placed several thousand math and

science teachers in summer employment with major corporations in order to enhance their knowledge and awareness of what is going on in industry. How can our science and math teachers teach young people, excite them about possible careers in the sciences and engineering, if they don't know what is happening in those fields? They need to have that first-hand knowledge, their "hands-on" experience, in order to do well.

We would like to start with our science and math teachers and expand to the middle school area and even to elementary teachers so that excitement for science, math, and the technologies could take place even at the kindergarten level.

One of the participants in this conference, Kermit Smith, has been very helpful in some of the partnerships in Prince George's County. His activity at Goddard involved Solar Max, which is a satellite that studies the activities of the sun. He has for the past two summers employed a number of our students in that project. Students have the opportunity to work on a project involving a satellite, retrieving data and helping scientists and engineers analyze the data. Where else can students get that kind of opportunity? We are hoping to work with Kermit and some of the other contractors here at Goddard to expand that concept to provide some opportunities for teachers.

Another participant, Cliff Lanham, represents the Harry Diamond Laboratories. Harry Diamond has been helpful to us in a number of ways. Not only has it adopted Roosevelt High School (through the Adopt a School Program), but it also has formed a new partnership between our Economic Development Corporation and the school system. Mr. Lanham chaired a committee which formed a week-long Science-Technology Summer Institute in which 20 teachers went to high-tech industries and for the first time saw what was happening. The teachers experienced "hands-on" activities at Litton/Amocon, the Bureau of Standards, Harry Diamond, EOSAT, and a number of other high-tech-oriented businesses. Now our teachers know about current technology, and they are asking school boards to help fund projects to make available the equipment students need to advance in math and science.

C&P Telephone has been an excellent partner, providing us with speakers for classrooms and science fair judges. C&P is also looking at our Adopt a School Program. These partnerships work because we don't tell the businesses what to do. When we have an interested business partner, we find out what interests them and how we can best match those interests with the mission of the school system. Our mission is to make sure that all of our students succeed. We want to close the gap between our black, white and ethnic students in the school system. We want our test scores to be above the 75th percentile level. We will do it; we need the community's help.

One thing I want to share with you is "how to." I realize a number of you have already established partnerships with your school systems, but I think it is critical to review some of the steps that we use to establish successful and effective partnerships. First, and foremost, is the commitment of a top executive and the superintendent of the school system. It is very difficult to work in an area that might be innovative, for example, hiring students or teachers, if you don't have somebody at the top level of the school system to help you through the legal work. But it is also essential to have commitments from top business officials.

We need to identify mutually agreeable goals. For instance, if a business is particularly interested in adopting a school, or wants to start small and identify people in the company who might be interested in being classroom speakers, then we need to agree on that. We want to make sure that we agree on initial goals. Start small. Make a success first; don't take on a project that is so grandiose that it is bound to fail. Make sure that you involve the key people who will make it successful.

Volunteers are needed to coordinate the program. Most executives do not have much extra time, although RCA was very generous with their executives' time in Camden, New Jersey. Sometimes it is people lower in the organization who will take a personal interest and participate in the project. In order for any partnership effort to work, it takes people. The people make a difference. You need more than one person. I have found it very worthwhile to involve groups of people in the company as well as at the school level, so that if someone is promoted or leaves the area, the project doesn't fall through.

Any program has to be monitored. How do you know your efforts are being successful? If you have a fund raiser, you obviously have a goal. When you set up a tutoring program in a school, you don't know what the results will be. PEPCO (the Potomac Electric Power Company) set up a tutoring program at Suitland High School in the spring of 1986. PEPCO brought in 18 engineers and scientists to work with an equal number of students who had problems in math. They had one-on-one tutoring. Half of the students passed the Maryland Functional Math test; it was the one-on-one tutoring that made an impact. PEPCO will repeat and expand that program.

The final critical factor in planning successful partnerships is publicizing the results. It's important to thank the people who do the work. We in Prince George's County have tried to do that. Our teacher recruitment efforts probably attracted many businesses to join our advisory council. If the program is good, if it is different, if it is getting results, it will get publicity.

Now we will take your questions.

QUESTION: I am addressing my question to Dr. Fowler. I think that the old National Association for Industry Education Cooperation had goals similar to the Triangle Coalition. Have you been in touch with them?

FOWLER: Yes, we have invited them to join. We want to locate all local action groups involved in improving science and technology education. Give us a contact, name and address, and we will send information to them. All sections of the American Chemical Society and all sections of the Institute of Electrical and Electronics Engineers have received material from us. It is important to realize that we are not trying to form "chapters" in the Triangle Coalition. We are trying to find places and things that are happening and see if we can help.

QUESTION: What effect did the delay of the Shuttle program from 1981 to 1983 have on the morale of students? What happened to morale after the project was over? What happened to the curriculum in the school?

CHAVIS: We were lucky; we were told by NASA officials at the beginning that we could expect delays. At the time our first schedule slipped, we had built two prototypes of the final system. When we were building the second prototype youngsters came in with recommendations for improvements, so we had a technical review panel meeting to approve the adoption of those improvements, which meant they were going to build prototype number three. Prototype number three looked entirely different from prototype number two. It was much more sophisticated, had better equipment, the latest RCA micro-processor; we used an 1802 circuit board. We gave the students the new 1802 micro-processors in plastic containers or bags with the drawings, and each week sent in a technician to assist in assembling them. The technician was breaking leads, and the students said, "We will take over." Each student who worked on building the computer had taken a soldering course (the technician hadn't soldered a lead for 20 years). So the students built an entirely new system which looked much better, performed better, and was state-of-the-art. It took a year to build. Building what proved to be the final system helped maintain interest in the program. The momentum never slackened. But, due to the delay, we had to continue to throw in challenges, more visits to the laboratories, let them have more freedom to build various parts; during the first year, they built a computer lab at Camden High School. We then went out to all of the computer companies we knew and asked for donations of computer equipment. AT&T donated a new type of computer, and Radio Shack and Commodore donated equipment. So did the computer stores in the area. The youngsters were allowed free access to the computer lab. In the meantime, Woodrow Wilson High School improved its mobile planetarium. We kept feeding them projects. They understood the cause for delays because they were kept informed by their newsletter. As for the curriculum, the South Jersey Chamber Foundation has republished the Orbit '81 curriculum for world wide distribution.

PALMER: I have two comments. First, it was a part of the educational process to learn that scientific and technological endeavors involve delay. I think that that was brought home very well from the beginning. Second, the project actually spanned several different classes in the school. This was not originally intended, but because of the delays, the upcoming classes had an opportunity to become the premiere participants after the seniors who had begun it had graduated. Interestingly enough, the high school graduates came back for the launch, so it also created or cemented a relationship with the alumni as well.

QUESTION: How did the death of the ants affect Orbit '81?

PALMER: The educational process had worked well enough so that the kids understood; they were disappointed, but they understood that there was substantial scientific significance to what they had done. The fact that the ants died didn't matter.

SNYDER: I think the Camden experience had a more far-reaching impact than these two gentlemen may realize. Both Montgomery and Prince George's County public schools were lucky to have Orbital Systems Limited donate a canister a couple of years ago. Enthusiasm has built. As I understand it, Prince George's County has completed seven experiments and Montgomery at least four.

QUESTION: How did you work Orbit '81 into the school's daily schedule?

CHAVIS: As the program progressed, we added an extra hour a day for the core students. The core students were always bothered by the other students who came to that extra hour. They took their regular scheduled math and science courses, and then after school they took their hour of Orbit '81 which usually extended to two or three hours.

QUESTION: What is the relationship, if any, between the Triangle Coalition and the National Science Teachers Association teacher certification project? Will what the Triangle Coalition does have an impact on teachers?

FOWLER: It has to have an impact or it won't work. The Carnegie Forum Task Force on teaching as a profession recommended a national board of certification with strong industry representation. I think NSTA's recommendations are complementary. It is a different kind of certification from NSTA, but we are all saying that everyone has a stake in science and technology education, so anything we do must involve everyone. The Triangle Coalition hopes to help spread a real, monitored and assisted volunteer program to schools around the county. We hope to work with IISME (Industrial Initiatives in Science and Mathematics Education) to make that a national program.

QUESTION: Mr. Drury, how was your program accepted by the school administrator's in Washington, and how did they coordinate their input?

DRURY: It has been accepted very well. I think your point is well taken, because I have discovered something that I didn't know when I became involved with this project. The school system is comprised of individual areas of responsibility, and each one is ruled by the principal. We have made a concentrated effort to reach the principal and, in fact, held an orientation session about a year ago, as we went into our first full year, for the principals. We had a good response and tried to maintain communications with them. When a volunteer is assigned to a school, the principal is notified. In fact, we don't assign volunteers to schools where the principal and teachers are not interested. Happily, a great majority are interested.

ISSUES, PROGRAMS AND PROSPECTS
Group I

Introduction of Mr. C. D. Burt

SMITH: Ladies and gentlemen, I think this has been a very fine conference. It has shown ways to implement future programs for industry/school partnerships. Let's now have a summary of the different sessions so that each group can profit from what the other has done. The first speaker will be C.D. Burt, to summarize his group's discussion. He is the Director of Human Resources at McDonnell Douglas Corporation.

He will be followed by the recorder for his group, Mr. Karl Taschenberger, Principal of the Robert Goddard Middle School, Prince George's County, Maryland.



ISSUES, PROGRAMS AND PROSPECTS Group I

Moderator:

Mr. C. D. Burt
Director of Human
Resources Operations
McDonnell Douglas Astronautics Co.

Recorder:

Mr. Karl Taschenberger
Principal
Robert Goddard Middle School
Prince George's County, Maryland

BURT: We were told by one of our NASA hosts that education is the largest single business in the United States, yet our nation faces a projected shortage of its scientific and technical talent base, declining numbers of qualified science and math teachers, and a general disinterest of students toward studying science and math. From an industry standpoint, I believe there is a need to begin networking with our educational system (especially in the lower elementary grade) offering our resources and time to help avert what could be a crisis for our nation in years to come. Some suggested actions from private industry are:

1. Develop publicity programs to advertise the real need for more math and science students
2. Expand our current school partnership programs to include teachers and educators working within industry to understand the need and application of science and math
3. Encourage employee volunteerism from private companies to work with schools.

In summary, I feel that industry must work to form a partnership with school systems to develop students' understanding of the rewards of math and science as a career path. To date, we have been reacting more or less on a community level. We must make a national issue of declining math and science students and educators and treat it as if it were a "business problem," collectively developing a strategic plan that will place us in a recovery mode. I would like to see NASA start this process. Thank you.

TASCHENBERGER: I am the principal at Robert Goddard Middle School, which has been "adopted" by the Goddard Space Flight Center and the local industry. It isn't always easy to define the areas of partnership. I didn't know what NASA could do; NASA didn't know what I could do. I think that you are going to find that this is often true.

We looked at the possibility of committee work with the State Department of Education. That is a long, slow process, as most of you know. Private industry can help by working with local school boards, coming in on a small level with a particular school or a particular district. We are now looking into "adopt a school" programs and "adopt a classroom" or "adopt a teacher" programs. We looked not only at having big business involved in education, but getting some of the small businesses involved. Education is big business in the United States, and it takes all of us working together to make it work.

ISSUES, PROGRAMS AND PROSPECTS
Group II

Introduction of Mr. Frank Owens

SMITH: You have heard from one forum. The other moderator is Frank Owens, the Deputy Director of the Educational Affairs Division at NASA Headquarters.



ISSUES, PROGRAMS, AND PROSPECTS
Group II

Moderator:

Mr. Frank C. Owens
Deputy Director
Educational Affairs Division
NASA Headquarters

Recorder:

Ms. Lezley K. Wilson
Productivity Program Manager
Office of Productivity
NASA Headquarters

OWENS: There was an interesting observation made in our group: "Where are the teachers?" We have government and industry, and we have people from educational administration. We have other participants. But where are the teachers? We talk about teachers being more involved in the decision-making process, but sometimes don't follow through.

There is a teacher, however, that I have had the opportunity to meet and work with over the last six months. She is from McCall, Idaho. This lady has become, in my estimation, one of the best spokespersons for the teaching profession. She is, of course, our future Teacher in Space, Barbara Morgan. Barbara, as did Christa McAuliffe, has a firm belief that she should return to the classroom after her year with NASA is over. Barbara is back in the classroom today.

Barbara made a speech at the Third NASA Contractor's Conference held May 7-8, 1986, in Palo Alto, California. She was speaking to a number of our aerospace contractors and called for certain actions, in support of education. I would like to share with you some of Barbara's comments and thoughts.

She noted that the work place is abstract to children. Children don't know what "work" is. They don't know what mommy and daddy do at work. Children need to understand work. We need to bring children and their teachers into the work place. Meaningful work experience needs to be translated to the classroom.

The second point she made was that we have to highlight and recognize good teachers and students. Barbara has always been very serious in saying, "I'm not the best teacher, I am only a representative of the millions of good teachers that are out there. There are many teachers that are better than I. I am representing them." There are many organizations throughout this country that have teacher recognition programs. We need to recognize good teachers.

A third point she made is that we have to bring education into society. To illustrate her point, Barbara shared a recent experience. She was going to a local science fair in Fresno, California. Since Barbara was going to be there, the press was going to cover it. Because she had the opportunity, Barbara asked the press a savvy question: "When was the last time you (press) covered a local science fair?" The fair has been held for 20 years, but had never been covered before. She asked the press to consider how much newspaper space is devoted to education, to the students, and to the recognition of teachers. She said, "Next year I know I won't be at this science fair, but I sure hope the press will." We have to bring education to society. That means we have to look at ways we disseminate information to the public. That means the media: print, television, and radio.

The last point Barbara made in summing up her remarks was, "We have got to continue. We want you, contractors and NASA, to continue what you are doing. That is to set the example of excellence."

Contractors and government, should assist both locally and nationally. That means they have to find and use existing systems and organizations. There are many things going on--organizations are being formed, such as the Teacher in Space Foundation and the Triangle Coalition. We need to look to existing delivery systems. We don't need to reinvent the wheel.

SESSION REPORT

Our session did three things. One was to brainstorm the kinds of programs that caught the attention and the imagination of the conference participants. Second, we looked at the process--the steps to take to generate some kind of action on ideas that have resulted from this conference. Finally, we asked what is NASA's role?

NASA has institutionalized its commitment to education. In 1958, NASA was formed as a partnership comprised of three entities. The first entity was in-house technical expertise; NASA has an excellent work force and unique national facilities. The second component of that partnership was private industry. NASA's contractors are equal partners in the team that contributes to the civilian aerospace effort. The third component of the partnership was academia, the universities historically have played a very important role in the NASA mission. It was that partnership, in-house expertise, the private sector, and academia that has led this nation forward in aeronautics and space.

There seemed to be a consensus within our session on providing work experience to teachers. Examples range from workshops, to summer hires, to some kind of ongoing relationship that exposes teachers to relevant and current employment situations. Once that contact is made, once teachers are brought into an organization, additional time is needed for them to meet together and process the experience so that they can make it applicable to the classroom.

Another vehicle for translating relevant work place experiences to the classroom is to foster mid career conversions from a technical field into teaching. Some universities, such as Harvard and the University of Maryland, have such programs. A point was made that the utilization of this talent pool may require some innovation by school systems such as flexible or part-time scheduling.

A second idea was networking. We need more forums in which teachers, government, and industry can initiate, develop, and perpetuate networks. This conference was cited as a good example. Additionally, there is a need for a national clearing house to provide information at the local level that fosters the development of these partnerships. One example, the Triangle Coalition, is in place and trying to serve that role.

The next question to be answered is how to implement new ideas or programs. Our group did not seem to reach a consensus on a particular method. However, the group recognized that it is important to find a key individual within an organization who can "press the button." That person must believe in the

program. In making contact between industry and the educational community, some tactical "lessons learned" were shared. The definition of a clear-cut goal, with corresponding requirements and outcomes, is paramount. A vague, general request for assistance or contributions on any level results in confusion and dissatisfaction. Educators can benefit from using an industry approach to planning. Another tactical lesson occurs is when a request is made to industry for a commitment of time rather than money. Experience shows that once the initial partnership is developed and a commitment is made to work for the enhancement of the educational component of the community, additional resources become a natural follow-on. High technology companies are not the only industries interested in the quality of the future work force. So-called low tech companies, the trades, and retirees are some additional resources to draw upon. Finally, while education is a national issue, the best solutions appear to be local. It is the partnering of local industry and local school systems that is having the greatest impact.

We discussed what NASA's role should be in developing partnerships with education, industry, and government. While there are many aspects of NASA's education programs, the group felt that perhaps the biggest role NASA can play in this area is to convene meetings such as this.

SUMMATION

Dr. Robert W. Brown, Director
Educational Affairs Division
NASA Headquarters

BROWN: My summation will try to hit some of the key points that we have heard over the past two days. John Nesbitt, in his book on megatrends, indicated that we are really an information society. One person may be an engineer, another a systems analyst, and another a physicist, but in the final analysis most of us are information workers. We process information and ideas. That is how we get our work done. So the information and the ideas that came out of this conference really represent the fuel and the oxygen for us to try to carry out the objectives that are so important to the goals for the future work force.

Let me run through some of the lessons that have been suggested.

Be a good listener. Don't over-ask. Listen to why people say no. Look for alternatives. Don't be so single minded that you don't look for other potential opportunities. We heard some very creative ideas from Dr. Culver of the Computer Science Corporation; one of the things that seems to have wider implication for all of us is their project involving minority youngsters at the eighth grade level, with plans to follow, support, and help finance those youngsters through college. That is an act of confidence. That is an act of faith; that is a worthwhile investment. As you might recall, Dr. Culver said that it will be nine years before they know whether this project is working or not, but they are willing to make that investment. They have confidence.

The other point that he made was business justification. One business justification for being involved in education is that the quality of the school system and the quality of the community affects the quality of the people who become part of the work force. So there is a vested interest here.

We had some very good lessons from Mr. Shulman, an attorney and member of the State Board of Education of Maryland. He made the point that there are two separate networks: the education community and the business community. It is the private sector that has to take the initiative with the education community. He pointed out to us as educators that even when a project has been approved by the school system, they still have to play by business rules.

Mr. Shulman remarked that business firms shouldn't try to run the school system. Rather, they should support it. He also said, don't try to teach the teachers. He said, "don't try to teach the teachers but by not trying to teach them, you will teach them." That is a handy concept. His message for the school system was that in working with the business community, don't try to just use them as advisors; use them as participants. They should be a part of the process.

We are very impressed with the Teacher Training programs of Rob Traver of Harvard University and Dr. Lockhard of the University of Maryland. We know about the increasing shortage of good quality teachers.

We are all impressed with the work on Orbit 81, the ant colony project. You will recall from Mr. Palmer's and Mr. Chavis' comments why that project

worked. It was the right project, there was a willing sponsor, there were willing education institutions, there was a focal point, there were prime movers, and there was enthusiasm.

We received an important message from Mr. Drury of the Federal City Council. It is possible to get volunteers from the community and make them available in the school system to help students with science and math.

We were impressed with the science and technology conference for elementary children in Montgomery County. Mr. Bailey said, "I don't see why we can't have 1,000 of these programs a year from now." If you have a good idea, one of our tasks and challenges should be to try to replicate that idea.

As a final comment, I want to reinforce the comments of Frank Owens, Mr. Bailey, and Dr. Fowler regarding where we go from here. Most of what is needed in science education and other disciplines will happen at the local level, in terms of local partnerships. At the national level, we should have a strategic convening of organizations and individuals, leveraging, setting up information systems, and pushing to replicate ideas. I would like to see some coming together of minds between NASA and the Triangle Coalition, which has a system in place that is getting stronger, as a way of continuing the partnerships that have been expressed here today. I hope that we will continue to be patient. I am all for enthusiasm, but sometimes we get so anxious that we want to pull up the plant and look at its roots to see why it isn't growing faster. We must nurture these educational partnerships. Finally, I want to give my sincere thanks to Goddard, to Mr. Crone, Mr. Bailey, Mr. Boyle, Mr. Hangey, and others for convening this group and making us all a part of it. Thank you.

SUMMATION

Mr. Charles Boyle
Special Programs Officer, GSFC
for Ms. Joyce Jarrett, Deputy Director
NASA Productivity Programs, NASA HQ

BOYLE: I am extremely grateful for your attendance and your participation. I am saying that for me, but also for Joyce because Joyce can't be here. There has been a family emergency. She called and said, "I can't come but the show must go on and will you, for me, thank the people for coming and thank them for participating." I said OK.

You are a team that I am proud to be part of. Elva and I were your co-chairmen. His thanks you have heard, and my thanks you have heard. But we can't repeat it often enough for the speakers, for the audience, for the moderators, for the recorders, for the supporters, for the planners and for a lot of service folks. . . some of whom are operating the sound system right now. There were transportation people, caterers, educators in the Prince George's County school system, and those at the Science Center.

Joyce asked me to speak for her because one of my functions is that of productivity focal point for Goddard. Every directorate has a focal point and you have had the benefit of some of their interest and talent. Meals and money were in the hands of Tom Hamilton. Tom Ramos managed all your transportation. And John Woodruff ran a variety of things a virtuoso manager makes look easy. Somebody from every directorate was involved. But there is a difference between involvement and commitment and I never heard it explained better than the "ham and eggs breakfast" comparison. As you look at the ham and eggs on a plate, it is clear that the hen was involved, but the pig was really committed.

There is a national urgency requiring that we commit ourselves to improving our productivity. I think what you are here to do is to work at the front end of that problem, the qualifications of the future work force. The work force of tomorrow is in the classrooms today. I was shaken by what I saw in one of today's handouts. The headline said there was a state of desolation in the schools. And I thought oh, gosh, more self flagellation of America. But when I read on, I found this was the conclusion from a review of the entire educational system in Japan launched by Premier Nakasone. Japan complaining about its schools! Amazing! If those people get any better, just what are we going to do? Their industry already has us huffing and puffing to catch up. That news story emphasizes, to a compelling degree, the nature of the urgency of what we need to do in blending business and industry and education. You are the kind of people, the right mix, to do the job we have to do. Thank you for your participation in two fine days of work.

WHAT'S REALLY HAPPENING

Introduction of Mr. Jack Anderson

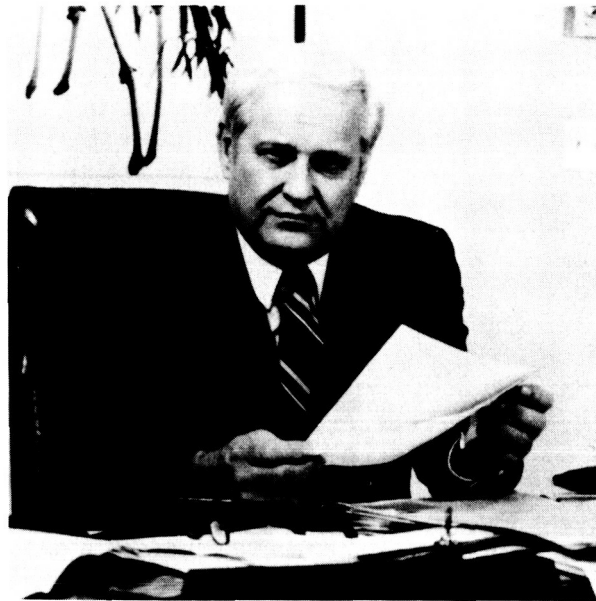
By Mr. John P. Scully

Deputy Director, Management Operations Directorate
Goddard Space Flight Center

SCULLY: I am pleased to have the opportunity to introduce Mr. Jack Anderson. First, NASA is privileged to have him as a speaker at the Conference on The Future Work Force; second, Goddard is pleased to have the opportunity for its employees to listen to this distinguished man; and as a fan, I am delighted to welcome this warrior of the fourth estate. Mr. Anderson was born and was raised in Salt Lake City, Utah. He has served as a Mormon missionary, a cadet officer in the merchant marine, and a civilian war correspondent. During World War II his draft board caught up with him behind Japanese lines in China. He was inducted in China and assigned to the Shanghai edition of the Stars and Stripes. In 1947, Jack Anderson joined Drew Pearson's staff and continued the column after Pearson's death in 1969. In 1972, he won the Pulitzer Prize for national journalism. Mr. Anderson's column appears in a thousand newspapers, including the Washington Post. He diversified into radio and TV. He became the eyes and ears in Washington for the Sunday magazine Parade. As a measure of his strong humanist values, this nationally syndicated columnist considers his greatest achievement to be his family. He has 9 children and 13 grandchildren. Finally, he is a strong supporter of a vigorous space program. Please join me in welcoming Mr. Jack Anderson.

WHAT'S REALLY HAPPENING

Mr. Jack Anderson
Syndicated Columnist



ANDERSON: Thank you. I probably should begin by telling you the story that Henry Kissinger tells about me. You may as well hear it from me. As Henry tells it, I was the first Washington correspondent to interview him after he arrived in Washington. For some reason, he was apprehensive about this interview; he somehow had the impression I might make him look bad. He handled the questions with extreme caution. Now I know a little about his background, his reputation as a swinger, and I asked Dr. Kissinger, "while you are here in Washington, do you plan to visit some of our night spots?" Well, he parried the question and responded very carefully by asking, "Are there any night clubs in Washington?" I reported afterward, quite accurately, "The first question Henry Kissinger asked after his arrival in Washington . . ." Well, the story is hypothetical; it didn't happen. Henry just likes to tell it like that; it introduces what it is I do. The other reporters cover the news; I try to uncover it. I try to dig up what the government covers up, and I am always glad to appear, therefore, before any government audience and seek recruits. We do believe that the government belongs to the people, that the people are sovereign, and that those who work for the government, in fact, do work for the people. The people, because they are sovereign, are entitled to know what their employees are doing. We believe that we are engaged in the people's work, that our founding fathers intended that the government should belong to the people, and that we, the press, should be the eyes and ears of the people and should represent the governed, and not the governors. So in a sense, we are a watchdog, and it is frankly in that spirit that I have accepted this invitation and that I keep an eye on the space program.

I am particularly pleased to be here and to talk to the people who put men on the moon, the people who will be exploring the universe. To me, there is nothing that could conceivably offer greater excitement. Every generation needs a dream to inspire it, an adventure to ennoble it. And never in human history has there been an adventure with the excitement and the appeal of space exploration. Our children, who seem to be jaded at this time, children who have

been beset, I suppose, by harmful experiences, are the most fortunate of all generations. Because there awaits them the greatest adventure that mankind has ever undertaken. As chairman of the Young Astronauts Program, I have had the opportunity of meeting some of you, and I have learned from you vicariously what it is like to leave this planet. I have talked to some of your astronauts who have actually gone and to some of your engineers who have sent them. When these astronauts let their hair down and talk to you in the deepest privacy, it is clear that this experience is a spiritual experience. I have never talked to an astronaut in quiet privacy who hasn't told me that the earth from outer space is the most beautiful sight that they have ever beheld. They tell me that it is a jewel of swirling and eddying colors, blues and greens and whites and browns. And that no words can describe the beauty, and no camera has ever caught it.

One astronaut told me that he started counting the shades of blue and counted 22 shades. They experienced a feeling of loneliness and kinship with those that they have left behind on earth, a feeling of brotherhood, a sudden recognition as they get out in space and look back upon our habitat, just a round ball, a spaceship, if you please, hurtling through the heavens, the realization that there are no other life forms within millions, perhaps billions of miles.

The recognition is that this is a spaceship and that any damage to the ship will injure all of the passengers, that the Soviet Union and the United States and the other nations seem to be stuck on the same planet and we know of no way of dividing them and sending them in separate orbit. We seem to be stuck together. These are some of the feelings and some of the vicarious experiences that I have received from you. And I am deeply grateful for the privilege of becoming involved, even through an auxiliary of your organization, the Young Astronauts, in this great adventure that you are undertaking on behalf of the people in this country and the world.

I know that since the Challenger tragedy there has been a let down. Oh Lord, we felt it as you did. You see, along with you, we, the Young Astronauts, co-sponsored that Teacher in Space Program. We brought Christa McAuliffe's son, and his whole third grade class, all of whom had joined the Young Astronauts, to the launch site. And we are the ones who brought all of the teachers, or at least the two top teachers, from every state to watch. The experience was so traumatic that some of our people had to go home and were sick for several days. Yet I know of no frontier that has ever been explored and can ever be explored without risk. It is part of the price. I know of no progress that has ever been made without risk. Since the Challenger tragedy, airplanes have crashed because of human mistakes and yet airliners continue to fly. Automobiles have crashed because of human error, and we continue to drive. And so we must continue in space. We cannot let down. If there are politicians who do not understand this, if there are members of Congress who are holding back, if there are people in political control who are now fearful of plunging ahead, they no longer represent the people of this country. Because the people are with you. I know this because we are in touch with this. I know this because I read the polls. I know this because I hear from the children who are going to inherit the country.

We have in the Young Astronauts Program about half a million children, and we have only been in operation a year. We are soon going to have millions of children, I am convinced. We received tens of thousands of letters from them after the tragedy, and these were some of the most mature letters that I have ever read. If I had thought of it, I would have brought a few of them. It would

have cheered your hearts to hear how the children took this. An 11-year old boy from California said, "When these astronauts died, many of us died a little in our hearts, but," he added, "I hope no silly thinking adults are going to stop the space program." This was the theme of all of them. I remember a young astronaut, a little boy from Mount Village, Alaska, an Eskimo boy. He wrote to us and said, "I wonder where we would be if our ancestors hadn't crossed the ice." And yet there are some who still hold back. And while they hold back, the Soviets, the Japanese, the Europeans are soaring ahead in space. According to Jane's Fighting Ships, they have won space. And according to Jane's, while we have been anguishing, while we have been contemplating our bellybuttons, the Soviets have been putting people in space. They have launched a space station. Their plodding engineers are now pulling ahead of our stop-and-start space program. Their cosmonauts have spent thousands of hours in space. Longer than our astronauts. They have built a space station called MIR, which, from all the information available to us, appears to be just the beginning of a huge space facility that is going to be built onto it, and their cosmonauts are now doing the type of construction in space that our people won't be doing for 10 years.

Well, this may be what some politicians want. There are politicians who are short-minded, shortsighted politicians who say, "Why should we be pursuing moonbeams when there are so many unmet needs here on earth?" Well, they don't understand the space program. They don't understand that the Apollo program, the landing of man on the moon, brought tenfold the benefits, ten times the benefits above the cost. There are two ways for us to stay ahead in technology. History has shown that. One is war. We will sharpen our technology if we have to go to war. That isn't the way we want to do it, is it? The other is space exploration, because it is on the cutting edge in developing technology.

My friends, space exploration is the key to the future. The nation that is first in space will lead in the technologies of tomorrow, and the nation that leads in technology will dominate the 21st century. I, on behalf of the Young Astronauts, want to call upon all Americans to join the space team and keep America number one. And the only thing that bothers us about what goes on here at NASA is the delay. Well, let's get going. Let's get back in space. Let's not waste time. We believe in safety, but the time has come to move on. You know, we got to know Christa McAuliffe, and we know the other teachers who were ready to go into space. We talked to most of them, and we haven't talked to a single one who isn't ready to get on another space shuttle. They are ready to go. Christa McAuliffe would have absolutely deplored the failure to follow in her footsteps. It would be a disgrace to her memory and to the memories of the other brave astronauts who died with her. Every last one of them would have wanted to continue. So do the American people. Well, the interesting thing is that is what my column is about today. So do the American people. I know it and the polls prove it, and I have got hold of one of the latest polls that was conducted just last month by American Market Opinion, which has been rated as one of the top four polling firms in the United States. How do the American people feel about it? Sixty percent believe the government should spend whatever is necessary to keep the United States ahead in space exploration. Seventy-one percent want the United States to stay ahead of the Soviet Union in space exploration. Seventy-three percent believe that NASA should remain on the cutting edge in developing new technologies. Seventy-six percent favor sending, not only astronauts, but key civilians into space. Eighty-five percent want to build a new shuttle. Eighty-nine percent want to get back in space to fly again with full awareness of the risks that

manned space flights present. So the people who own this country are behind you. The people who own this country, the people who are the true sovereigns of this country, support this program. It is only the politicians who are giving you trouble.

Now we do have a problem. We are living at a time when we are rushing into the future at such breathless speed that we are likely to arrive there before we are ready. As an example, let me go back to 1956, when the Soviets launched their first Sputnik into space. It created great excitement; as a newsman, I interviewed one of our space experts, and I asked him whether we would be able to duplicate the Soviet feat. He said, "Of course, we are going to have a satellite up there." And as we talked I went on and said, "Well, do you think we will ever be able to land a man on the moon?" He said, "Sure." I said, "Would you be willing to speculate how soon that might be?" Now he paused at this and finally said, "Yes, I will give you a prediction but first I had better explain it." He said, "During the past ten years, [that would have been 1946 to 1956] we have doubled the world's knowledge. I am going to have to take that into account. If you were to measure it on a chart, we have been acquiring knowledge first at a very slow rate, and the line would go almost parallel and then gradually steepen and then incline a little steeper and now it is going straight up. We are learning so fast, the faster we learn, of course, the more we learn, and the more we learn, the faster we learn. And I had to take that into account. I have to take into account the almost certain fact that we are going to discover things that to me today are incomprehensible. And we are going to discover them in the near future. And I have to figure that into my calculation. So taking the incomprehensible into consideration, I will make you a prediction. I predict that we will land a man on the moon about the end of the century." That gives you some idea of how fast we are moving.

Well, my friends, we can't afford to stand at the bus stop too long. We are going to have to get on the bus. We are going to have to move ahead. And one man who understands it is the President of the United States. Some of the people around him don't seem to, but the President does. I have had long talks with him about it. This is the reason that he founded the Young Astronauts movement. And I can tell you another thing: that it would absolutely appall him for anybody to believe that there was anything political in his doing it. I have often been a critic of Ronald Reagan. That didn't stop him, and doesn't stop him, from working with me to get our kids ready for the 21st century. He believes that it is essential, and he wants our kids to get ready. And he is absolutely appalled at the statistics. The statistics are alarming, frightening, dangerous; our kids are just not getting ready. We have neglected them. Every study that comes down scares me a little more. Seventy to ninety percent of the high school graduates from the Soviet Union, from Japan, from West Germany, are proficient in science and math-seventy to ninety percent. Six percent of our high school graduates have attained the same proficiency.

The average Japanese high school graduate is better educated than the average American graduate. And why is this? Well, it is an attitude that they have toward education. Their parents, their families, have a respect for education. In Japan, the teacher is in the top ten percent of the salary scale; in the United States, the bottom ten percent. In Japan, the teacher is respected; in the United States, not always. In Japan, the kids go to school 270 days a year. In the United States, 170. In Japan, when the kids come home, they get down to

their books, and they study for two hours on the average. Our kids come home and watch television. The average amount of homework is less than 30 minutes. In Japan, the kids want to learn because they are taught at home to learn, and they take the tough disciplines, the tough courses. In the United States, they take the snap courses. In Japan, they are interested in getting an education. In the United States, they are interested in getting grades and diplomas. Now we have got to turn that around, and I can't think of a better way to do it than the space program. If there is one way to excite our kids, this is the way to do it, and it is working. We have had remarkable results in just one year as children across the country join the Young Astronauts Program and get excited about space. They want to explore Mars; they want to build in space; they want to be the Columbuses and the Magellans of the future. They know in order to do it they are going to have to learn; they are going to have to study, and they are going to have to understand the technologies of tomorrow. They are beginning to do it. The kids who are joining the Young Astronauts Program are beginning to do it; they are beginning to understand, they are beginning to feel the excitement. We had a pilot program in the inner city that I visited. When we came to them with the Young Astronauts Program, the teachers were despondent, and they shook their heads and they said, "We have tried everything, these are street kids. I mean we have had recreation, we have had sports, we have had dances, we have had hobbies, we have tried everything, we can't motivate them." We said, "Try space," and we gave them our program. I personally went back there at the end of June, after they had been at it for a year, and they had these little street kids excited. They were blowing up balloons with helium and trying to figure out why these things rose in the air, why they were lighter in air. They were excited. The teachers were turned on because it was space and because now they had a way of getting out of the ghetto. For the first time these kids understood that maybe they could explore space. And they got turned on. So we have a chance, but we have got to keep at it. The first nation that came to visit us after we set up the Young Astronauts Program, the first delegation that came to study, was Japan. I mean they are determined to get ahead. And if they want to, we help them. We helped them in every way we could because if they are willing to do it, they deserve to beat us. We are going to have to compete, and it is going to have to be honest competition. And we are going to have to get our kids ready. They are getting theirs ready. They invited us to send a delegation to Japan on August 22nd. We had some Young Astronauts and one of your astronauts. We sent a delegation over to Japan to help them launch their Young Astronauts Program, and already they are recruiting young Japanese by the thousands. I just told you about the Japanese school system and how superior it is to the United States. As I walked into this room one of your people handed me a clipping about education in Japan. Let me read you the headline. "FINDING A STATE OF DESOLATION IN THE SCHOOLS, JAPANESE LEADERS PLAN A SWEEPING REVISION OF THE EDUCATION SYSTEM."

The problem with children's education is just not on the subject of space; it is on all subjects. I was talking to a scholar who works with college students in California, and he told me that he was appalled at the ignorance of these kids. He said, "They are not learning anything." And finally he conducted his own survey; he took, he said, 12 typical kids and he started asking them questions and keeping track of the results. He said two of them didn't know where Chicago was located. One of them thought Toronto was in Italy. Another thought that the nation's capital was located in the state of Washington. He showed films of Lech Walesa and his Solidarity movement, and the crackdown by the Polish security.

And after showing this brutality toward the labor movement in Poland, a UCLA junior asked, "Well, why don't they leave?" He said, "The government won't let them." And she was appalled. And she said, "Why not, is this something new, how long has this been going on?" He showed them pictures of Adolf Hitler, in the dying days of the Third Reich. It was a demented and a defeated Hitler and he was ranting and raving in German subtitles and he said, "I tried to avoid World War II, but the Russians and the English, they forced me into World War II." And after the film, a University of California junior said, "Why did England and Russia do that?"

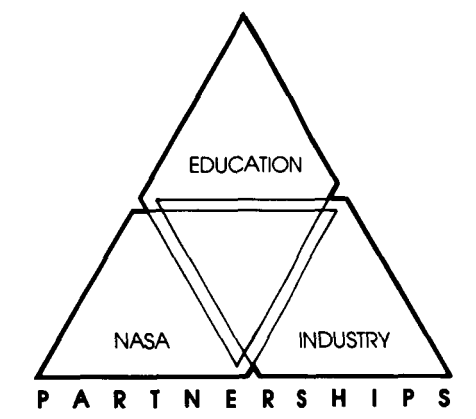
My friends, if this is the younger generation that is going to take over, they are not ready. They are not ready to lead. And it is about time we did something about it. I couldn't believe the results. I said, "Oh, it is Southern California, what the heck." But you know, since then, as head of the Young Astronauts, I have gone around a little bit and I have talked to other educators and I keep telling them about this poll. I say, "Does it seem right?" They say, "It sounds right. It doesn't surprise us." I have been hearing this all over the United States. Well, I couldn't believe it so I tried it on my own kid. He just got out of high school. I said, "Where is Toronto?" He said, "I think it is in New Jersey." Now he knew where Washington D.C. was, and I think it is because he lives here. He didn't know who Lech Walesa was; he knew about Adolf Hitler because he had seen a movie. I couldn't believe it.

We have been neglecting our children. It is not too late. They are warm, willing, wonderful kids. They can still keep America number one. They are innovative, they are great. But we have to get them ready, we have to do our part in it. That is why I am at this conference. Because space is the way to go and our kids are getting ready.

APPENDIX

APPENDIX A - Conference Program

The Future Work Force Conference



September 10-11, 1986

Goddard Space Flight Center
Greenbelt, Maryland

APPENDIX A - Conference Program

THE FUTURE WORK FORCE CONFERENCE September 10-11, 1986 GODDARD SPACE FLIGHT CENTER

A forum for the exchange of ideas and information on partnership initiatives with elementary and secondary schools to enhance the quality of the future work force.

PRESIDING: Elva Bailey, Educational Programs Officer
Charles P. Boyle, Special Programs Officer
Goddard Space Flight Center

**Wednesday, September 10, 1986
Auditorium, Building 3**

8:00 REGISTRATION AND REFRESHMENTS

8:30 NASA WELCOME AND OVERVIEW

Joyce Jarrett, Acting Director
NASA Productivity Programs, NASA Headquarters

Dr. Robert Brown, Director
NASA Educational Affairs Division, NASA Headquarters

GODDARD WELCOME AND COMMENTS

Dr. Noel W. Hinnners, Director
Goddard Space Flight Center

9:30 "PARTNERING REALLY WORKS"

Dr. Frank Driscoll, Superintendent of Schools
Oxford, Massachusetts

10:00 "HOW BUSINESS HAS RESPONDED"

Dr. Walter Culver, President
Systems Division, Computer Sciences Corporation

10:30 BREAK

10:45 "THINGS THAT CAN BE DONE"

Mr. Lawrence A. Shulman, Attorney
Shulman, Rogers, Gandal, Tobin and Ecker, PA

11:15 PANEL

Moderator: Dr. J. David Lockard
Professor of Science Education
University of Maryland

APPENDIX A - Conference Program

12:00 TRAVEL/LUNCH AT GODDARD RECREATION CENTER

Afternoon Moderator: Dr. Robert Brown

1:30 "MID AND LATE-CAREER CONVERSIONS"

Dr. Katherine Merseeth, Director of Teacher Training
Harvard Graduate School of Education

DISCUSSION

2:15 "PARTNERSHIP ACTION IN PRINCE GEORGE'S COUNTY"

Dr. John A. Murphy, Superintendent
Prince George's County Public Schools

DISCUSSION

3:00 BREAK

3:15 "THE BELLOWS EFFECT"

Dr. Antoinette Favazza-Wiegand, State Director
Maryland Summer Centers for the Gifted and Talented

DISCUSSION

4:00 "PARTICIPANT'S-CONTRIBUTIONS" BRIEFING

Kermit L. Smith, Senior Scientist
Lockheed Palo Alto Research Labs

4:10 TOUR OF GODDARD SPACE FLIGHT CENTER

William O'Leary, Office of Public Affairs, GSFC

5:00 HOWARD B. OWENS SCIENCE CENTER

9601 Greenbelt Road
Lanham/Seabrook, MD 20706

MIXER

DINNER

7:00 BRIEFING

Dr. H. B. Lantz, Jr., Supervisor, Howard B. Owens Science Center
Prince George's County Public Schools

7:20 OPEN HOUSE

9:00 DISTRIBUTION OF LITERATURE (Homework)

LIGHTS OUT

APPENDIX A - Conference Program

**Thursday, September 11, 1986
Auditorium, Building 3**

8:30 REFRESHMENTS & ASSEMBLY

9:00 "RCA AND THE SOUTH JERSEY EXPERIENCE"

Thomas Chavis, RCA Retiree & Consultant

James Palmer, President, Telenex Corp.;
Chairman, South Jersey Foundation

9:30 "ALLIANCE IN THE NATION'S CAPITAL"

Theodore D. Drury, Director, Science/Math Education Project
Federal City Council

10:00 "CHILDREN'S SCIENCE CONFERENCE"

Dr. Charles LaRue, Director, Elementary Science
Montgomery County Public Schools

10:30 BREAK

10:45 "PARTNERSHIPS IN SCIENCE AND TECHNOLOGY EDUCATION"

Dr. John Fowler, Director, The Triangle Coalition

11:15 PANEL

Moderator: Kathleen Snyder, Special Assistant to the Superintendent
Prince George's County Public Schools

12:00 TRAVEL/LUNCH AT AUDITORIUM, BUILDING 26

12:45 ISSUES, PROGRAMS AND PROSPECTS

(Participants will meet in three groups.)

Group I - Moderator: Kermit Smith

Recorder: Scott E. Hangey
Intergovernmental Personnel Act Appointee
to Goddard Education Office
Prince George's County Public Schools

Group II - Moderator: Frank C. Owens, Deputy Director
Educational Affairs Division,
NASA Headquarters

Recorder: Lezley K. Wilson
Program Manager
NASA Productivity Programs,
NASA Headquarters

APPENDIX A - Conference Program

Group III – Moderator: C. D. Burt
Director of Human Resources Operations
McDonnell Douglas Astronautics Company

Recorder: Karl Taschenberger, Principal
Robert Goddard Middle School
(Formal Partnership School with GSFC)
Prince George's County, Maryland

**2:00 TRAVEL TO AUDITORIUM, BUILDING 8 FOR
REPORTING SESSION**

2:15 MODERATORS REPORT ON GROUP SESSIONS

3:00 CLOSING/SUMMATION

Joyce Jarrett

Dr. Robert Brown

3:15 MIXER

3:30 INTRODUCTION OF SPEAKER

Dr. Noel W. Hinnens

"WHAT'S REALLY HAPPENING"

Jack Anderson, Syndicated Columnist

DISCUSSION

5:00 OPTIONAL TOUR OF CENTER

APPENDIX A - Conference Program

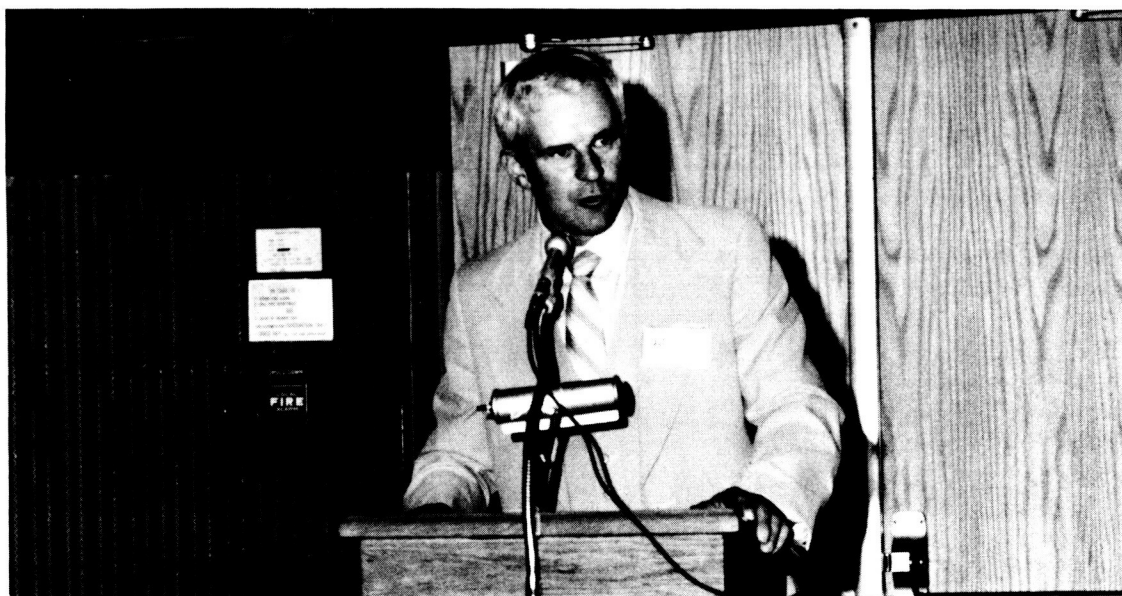
ANTICIPATED OUTCOMES

1. An understanding of the needs for, and the benefits derivable from, school and industry alliances.
2. An awareness in the NASA/Contractor community of tried and tested activities and alliances.
3. Identification of potential, promising activities and alliances.
4. Identification of ways and means to enhance existing, effective programs.
5. An understanding of the characteristics and common elements that exist in programs that work.
6. More widespread knowledge of organizations and resources available to help industry contribute to the goals of quality education.
7. Motivation to initiate promising programs and continue the proven.
8. Determination of next steps.

APPENDIX B - Howard B. Owens Science Center

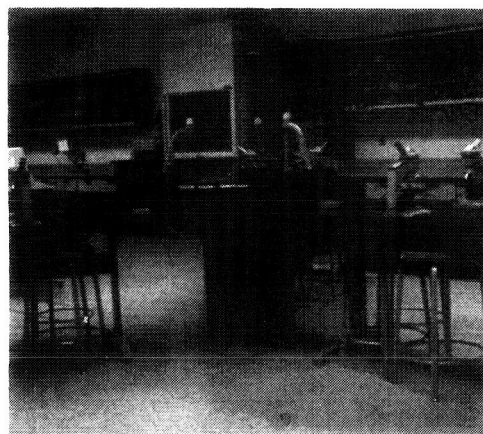
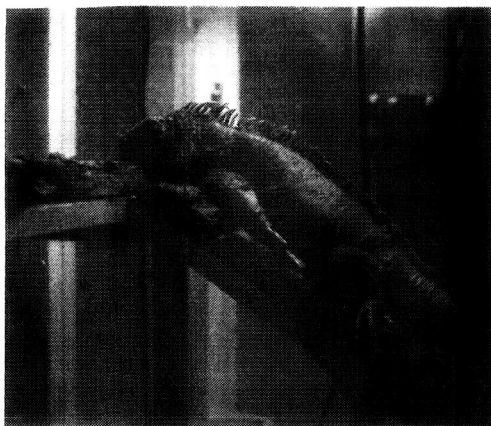
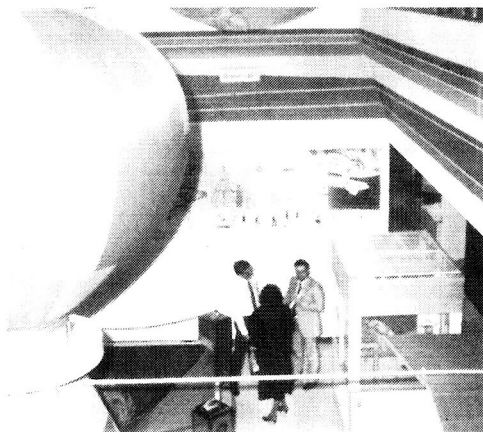
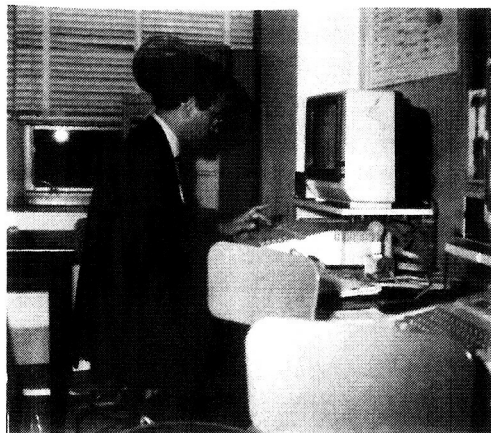
THE HOWARD B. OWENS SCIENCE CENTER

If you could take the best from the science museums, science centers, and science classrooms across this country, then you could begin to paint a reasonably accurate picture of the Howard B. Owens Science Center. A result of the vision of the late Dr. Howard Owens, the science center that bears his name has served as a beacon for science education for the Prince George's County Public Schools since the doors opened in the fall of 1978. Each year over 80,000 students experience science and technology "first-hand" at the Owens Science Center, with specialized facilities, programs, and interactive exhibits that in varied combinations are used to teach, enthrall, and excite students of grades K-12. Although the students of the public schools of Prince George's County are the primary target population, other audiences for the services and programs of the Center include the general public and the teachers of this large, sprawling, metropolitan school district. Continued opportunities for staff development in science and science education are available through afternoon/evening sessions at the Center. Planetarium programs, summer science enrichment classes, and other unique activities are offered to the general public. In serving these diverse populations, the goal of the Howard B. Owens Science Center is to make science and technology the exciting, dynamic, and ever-changing enterprise for them that we in the science field know it to be.



Dr. H. B. Lantz, Jr.
Supervisor
Howard B. Owens Science Center
Prince George's County Public Schools

APPENDIX B - Howard B. Owens Science Center



APPENDIX C - Future Work Force Conference Advisory Committee

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Transportation	Thomas Ramos
Finances	Thomas Hamilton
Meals/Refreshments	Thomas Hamilton
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Publicity	James Elliott/Randee Exler/ Lezley Wilson
Recording & Video Support	Scott Hangey
Literature/Speeches/Publications	Richard Crone
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Security	Candace Livingston
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Owens Center Liaison	Scott Hangey
Materials and Supplies	Barbara Reamy
Management Colloquium	Helen Phillips
Speaker Acquisition/Coordination	Charles Boyle/Elva Bailey

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